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## THE ANCIENT GLACIERS OF THE ROCKY MOUNTAINS.

BY ARCHIBALD GEIKIE, F.R.S.[1]

AMONG the many profoundly interesting questions in American Quaternary geology, one of the most important is unquestionably the determination of the area and movements of the ice during the glacial period. In the Eastern States much has now been done towards the elucidation of this problem. The general southern limits of the great ice sheet, and its course from Canada southwards have been more or less definitely fixed; though much remains to be done before our knowledge even on these points can be regarded as more than a mere outline of the truth. When, however, we try to realize the relations of the ice-sheet westward of the Mississippi basin, we soon perceive the meagreness of our information in regard to these vast western regions. But it is there that one of the most remarkable parts of the glacial problem must be solved. The important labors of Dr. Percival and Profs. Whitney, Irving and Chamberlain, have shown that even within the area embraced by the northern ice-sheet, there was a tract of about 12,000 square miles in Wisconsin that escaped glaciation. Prof. Irving points out that this tract does not owe its immunity from glacial drift to its being higher than the surrounding ground; on the contrary, it is actually lower than the ice-ridden region in Minnesota to the west of it. He supposes it to have escaped because it lay between deep depressions leading out of Lake Superior, by which the great mass of ice, filling that basin, moved off to the south. If this be the true explanation, and it bears strong evidence of probability,

[1] Director of the Geological Survey of Scotland.

the ice-sheet must evidently have become considerably attenuated in the Wisconsin region, though still retaining momentum sufficient to carry it down the Mississippi valley into Missouri and Kansas. In Dr. Aughey's recent interesting volume on Nebraska, the extension of the ice westward into that State is clearly proved, and the ice-movement is there shown to have taken a south-south-east direction, or down the Missouri valley. No doubt the glacier had thinned away greatly in that region. Its south-western and western margin, however, remains to be traced up the plains watered by the Missouri. And the day is probably not far distant when the work so well done by Mr. Dawson, in British Columbia, will be prolonged into the Missouri region, and the precise limits and course of the ice-sheet will be mapped across the whole breadth of the continent.

Subsequent explorations have amply confirmed the original observation of Prof. Whitney as to the driftless nature of the surface of the vast interior region lying between the Missouri valley and the Sierra Nevada. The fact may seem almost incredible that the low ground of Eastern North America should have been buried under a southward-creeping ice-sheet, from which the lofty plateaux of the West remained free. The cause of this difference was probably meteorological, as Prof. Dana had pointed out, the snow-fall over the Rocky mountains and western ranges having been insufficient to give birth to a general ice-sheet descending from those heights into the plains. But the question remains: what was the probable condition of the West during the time when glaciation in the East was at its height? We must remember that a considerable portion of the ground through which the drainage of the western plateaux and mountains now reaches the sea, was then blocked up with ice. The valley of the Missouri with all its tributaries on the right down into Kansas, was under ice. Any water-drainage from the west would be ponded back by the great tongue of ice that crept continuously southward from British America, and would no doubt flow parallel with the ice and join the streams, escaping from its melting end. I am not aware, however, that any evidence of such arrest of drainage has yet been met with, though it is a point deserving of attention.

That the mountain ranges of the West had their glaciers, is now well known. Even at the present time, as Mr. Clarence

King announced in 1871, there are true glaciers in the Sierra Nevada, and Dr. Hayden's Survey has more recently found others among the Wind River range in the Rocky mountains. But during glacial times the quantity of snow and ice in some of these uplands, was enormous. In the Uintah mountains the traces of vanished glaciers are singularly fresh. Beautiful horse-shoe-shaped morainal-mounds, occurring far down the valleys, mark pauses in this final retreat of the ice. These have been well described by Mr. S. F. Emmons and Mr. Clarence King, whose narrative I can fully confirm from my own observations. In the Wasatch mountains, also, as the same observers have shown, some of the principal valleys were occupied by glaciers. I was particularly struck by this proof of glaciation in the region of the Cottonwood cañons. At the mouth of the gorge of the Little Cottonwood stream, a pile of morainal-heaps lies on the edge of the highest of the series of ancient terraces of Great Salt lake. There can be little doubt that at the time of the greatest extension of this sheet of water, when filling the vast basin named Lake Bonneville by Mr. Gilbert, it escaped by a northern outflow into the Snake river and the Pacific, glaciers crept down the valleys on its eastern side, and in one case, at least, advanced into its waters. At this locality the ice descended to within 5000 feet of the present sea level.

But the most startling testimony to the size of the western glaciers, which I met with in the course of a recent journey through these regions, was supplied by the valley of the Yellowstone river. I entered this valley from Fort Ellis, in Montana, a little above the first or lowest cañon. One of the earliest objects to arrest my attention was a prominent rock, like a cottage, in the middle of the alluvial plain. I found it to be a large block of granite measuring 18 × 12 × 10 feet, and weighing upwards of one hundred and fifty tons, which with many smaller erratics lay upon rudely crescent-shaped mounds. There could not be the smallest doubt that these were moraine-heaps, nor that the glacier which carried them must have been very much larger than any of which I had seen traces among the Uintah or Wasatch mountains. The broad valley is here full of moraine-stuff. How much further north the transported material extends, I had no opportunity of ascertaining. But as it is still in full force at the 5000 foot contour line, it evidently descends to a much lower level

than among the Uintah and Wasatch mountains, three hundred and fifty miles further south. Here then was a great glacier moving northwards, while in British Columbia, on a parallel only about two hundred and fifty miles further north, there was a massive ice-sheet moving southward. It will be a point of no little interest to trace these two converging ice streams towards each other.

In ascending the Yellowstone valley towards the National Park, scattered moraine-mounds and abundant transported blocks continue to denote the course and size of the former glacier. I was wholly unprepared, however, for the intense glaciation of the second cañon. This ravine had been cut to a depth of at least eight hundred or one thousand feet in the schists and other older crystalline masses of the region. At its lower entrance a few prominent rocky knobs project from the steep declivity upon the flat alluvium on the left bank of the river. Great was my astonishment to find these spurs of the mountain-side as perfectly smooth, polished and striated as those at the margin of any Swiss or Norwegian glacier. The striæ were directed upward over the ridge, and showed how the ice had been pressed out of the gorge over this opposing barrier of rock. The steep sides of the cañon have been ground smooth and striated in the same way, as far up as I could see, certainly not less than eight hundred feet. Even from below the eye could follow the deep parallel scorings along the ice-worn sheets of gneiss. The glaciation reminded me more of the valley of the lower Aar glacier, above the Grimsel, than of any other European piece of ice-work. As the ice-worn surfaces descend to the modern alluvium of the river, it is clear that there has not been any large amount of erosion in the cañon since the glacier left the scene. I think it is equally certain that the cañon already existed before the glacial period, and that the work of the ice has been to grind it out deeper and wider.

Above the second cañon the moraine-heaps become more abundant and tumultuous. Here and there they enclose small lakes. The tributary valleys too have their moraines and erratics and must have been filled up with ice. Impressive testimony to the magnitude of these ice-masses, is found in that section of the Yellowstone and its surroundings, between Gardiner's river and Mount Washburn. The trail from the Mammoth springs by Blacktail Deer creek, over to the Yellowstone, leads the traveler

across mounds of glacial débris among which huge boulders of granite and granitoid gneiss are conspicuous. The transported character of these materials is all the more evident from the fact that the platform of solid rock on which they rest often consists of various lavas and other volcanic masses. Some parts of the route present long smooth slopes dotted with boulders precisely like some Scottish boulder-clay moors. The granitic blocks are conspicuous objects even from a distance, owing to their size, a length of six to eight feet being common among them. These signs of glaciation can be traced up to and across the water-shed leading over to the Yellowstone valley. They prove beyond question that not only was that valley filled up with ice, but that the glacier plowed over the ridge one thousand feet above the valley bottom and passed into the country lying to the westward. No old glacier valley in Europe presents a more characteristic scene of ice-drift erratics than does that of the Yellowstone for three miles below Lower falls. The large blocks of granite, gneiss and other crystalline rocks are scattered about so profusely that one might cross the ground for some little distance by leaping from boulder to boulder. The blocks are heaped upon mounds of moraine-stuff, perched on ice-worn hammocks of gneiss, and stream over the horizontal volcanic sheets through which the ravines have been cut.

As the determination of the distribution of the erratics gives an approximate indication of the thickness of the ice, I noted with the aneroid the positions of blocks of granite, gneiss and other non-volcanic rocks on the way up to Mount Washburn, which projects so conspicuously into the valley of the Yellowstone. These blocks get fewer in number and smaller in size as they are followed upwards; but I observed one of three feet long at a height of 8650 feet on the west side of the ridge which rises southward into Mount Washburn, and another about one foot in diameter at a height of 8900 feet. From the position in which these erratics lie, the traveler looks clear over the Yellowstone valley for many miles to the east and west. The general level of the valley-bottom above the edge of the cañon, on the north of Mount Washburn, may be taken at between 6000 and 7000 feet. South from that eminence it rises to more than 8000 feet. The general slope is about 2000 feet in fifteen miles, or roughly, about one hundred and thirty-three feet per mile. The ice, after pass-

ing the barrier of Mount Washburn, cannot have been less than 1650 feet thick (= the height of the three feet boulder on the crest of the ridge), and probably was at least 1900 feet (= the height of the highest observed block). That mountain projecting as a great barrier in the pathway of the ice served to ridge it up, and no doubt partly to deflect it. I observed a granite block south of Dunraven pass, on the south side of the mountain, at a height of 8600 feet, and moraine-stuff and erratics, at intervals, down to the very edge of the Grand cañon, and beyond even as far as the water-shed of the Fire Hole river. Whether Grand cañon existed in glacial times, I found no evidence to prove; but I am inclined to believe that it probably existed only in a rudimentary condition, and has been mainly excavated since that period.

From the evidence here cited, it is clear that the ice of the Yellowstone valley was more than that of a mere local or valley glacier. It was massive enough to fill up the main valley and override the surrounding hills, crossing minor water-sheds and spreading into adjacent drainage basins. From elevated points in the Yellowstone valley, the distant outlines of the Wind River mountain or their northward prolongation can be seen to the south-east, while southward rises the lofty peaks of the Tetons. That these mountains, though not within the present water-drainage basin of the Yellowstone, were within the ice-drainage of the ancient glacier of that valley, is, I think, extremely probable. The abundant blocks of granite and granitoid gneiss lying within the volcanic area of the Upper Yellowstone, seem to have been derived from cliffs outside the basin. Of course I had no opportunity of tracing them to their source. But I could hardly doubt that it will be found in the central archæan cores of these distant mountains. Should this view be confirmed, it will supply an additional proof of the magnitude of these ancient glaciers, for it will show that the snow fields of the Wind River and Teton ranges were so extensive that their ice rivers streamed northward across the buried water-shed, and poured into the basin of the Yellowstone. According to Dr. Endlich, the old glaciers on the west side of the Wind River mountains pushed their way out into the plateau country for several miles, and piled up moraines there to a height of 800 or 900 feet. It is much to be desired by all who take an interest in glacial geology, that an exploration

should be made of the country lying in the Yellowstone valley northward into the area of northern glaciation within the British line. Such a survey will show whether there was any connection between the massive glaciers of the Rocky mountains and the great northern ice-sheet; whether the latter, as it moved down the valley of the Missouri, was swelled by the accession of ice-streams from these mountains. The main facts could be gleaned with comparative ease. The country, no doubt, is the haunt of Crows, Blackfeet, Gros Ventres and other Indian tribes who have recently shown little sympathy with the white man. But this is a difficulty which patience and tact would overcome. The geological harvest is ample, and only waits the advent of some bold and skilled observer.

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## THE DISCOVERY OF IRON IMPLEMENTS IN AN ANCIENT MINE IN NORTH CAROLINA.

BY FREDERIC W. SIMONDS.

IN Western North Carolina are found many evidences of prehistoric mining operations, such as open cuts, tunnels, shafts and dumps. The latter are covered with a forest growth of several hundred years, and in the excavations has accumulated the débris of centuries.

About ten years ago a new industry was inaugurated in the State, that of mica mining, and strange to say, the best and most profitable mines have been those located upon the sites of the "old diggings." In clearing out the ancient works very few implements have been found which throw light upon the original miners. The opinion, now generally held, is, that they belonged to the Mound-builders, whose mounds are also found, but sparingly, in the river basins. That this is, for the most part, correct, I think has been clearly shown by Prof. Kerr in his Report on the Geology of North Carolina for 1875. He there states that he learned in a conversation with Col. Whittlesey, and subsequently from numerous publications on the subject of the mounds of the Northwest, that mica was of common occurrence in the tumuli of the Mound-builders, among the utensils and ornaments which such rude people are in the habit of inhuming with their dead owners. And upon further inquiry, he ascertained that cut forms, similar to those found in the mounds were occasionally

discovered among the rubbish and refuse heaps about and in the old pits.[1]

When Prof. Kerr's attention was first called to these prehistoric excavations (1867), he was invited to visit some "*old Spanish silver mines*" which had been discovered a few miles south-west of Bakersville, in Mitchell county, showing that by some means the inhabitants had associated these works with the early explorers of our country. It seems probable that tradition may have given rise to this impression, for in a letter written by the Hon. T. L. Clingman, who is very familiar with Western Carolina, I find the following: "The old Cherokee Indians, living in some of the western counties, used to speak of a tradition coming down in their tribe, that long ago companies of white men came on mules from the south, worked during the summer and carried off a white metal with them."[2]

The evidence of the former exploration of this region by white men—Europeans—in search of the precious metals, has not, until recently, been very strong, although in many instances the works indicated a considerable skill in mining, and in a few cases marks have been found as if made by some metallic instrument.[3]

This summer, for the first time, I learned that some iron tools had been found in an old shaft in Macon county.[4] Upon inquiry, I found them in the possession of Mr. Albert S. Bryson, a merchant in Franklin, the county seat of Macon. From him and others I ascertained the facts here stated.

In 1875 the Guyer mica mine was opened on the site of a "prehistoric working" on the mountains near Iola creek, northwest of the town. There was a basin-like depression some eighteen feet in diameter, at the bottom of which was a shaft apparently about eight feet deep. In carrying on the necessary mining operations this old shaft was cleaned out and found to be of considerable depth. In the rubbish which had accumulated

[1] Report of the Geological Survey of N. C., Vol. I, p. 301, 1875.

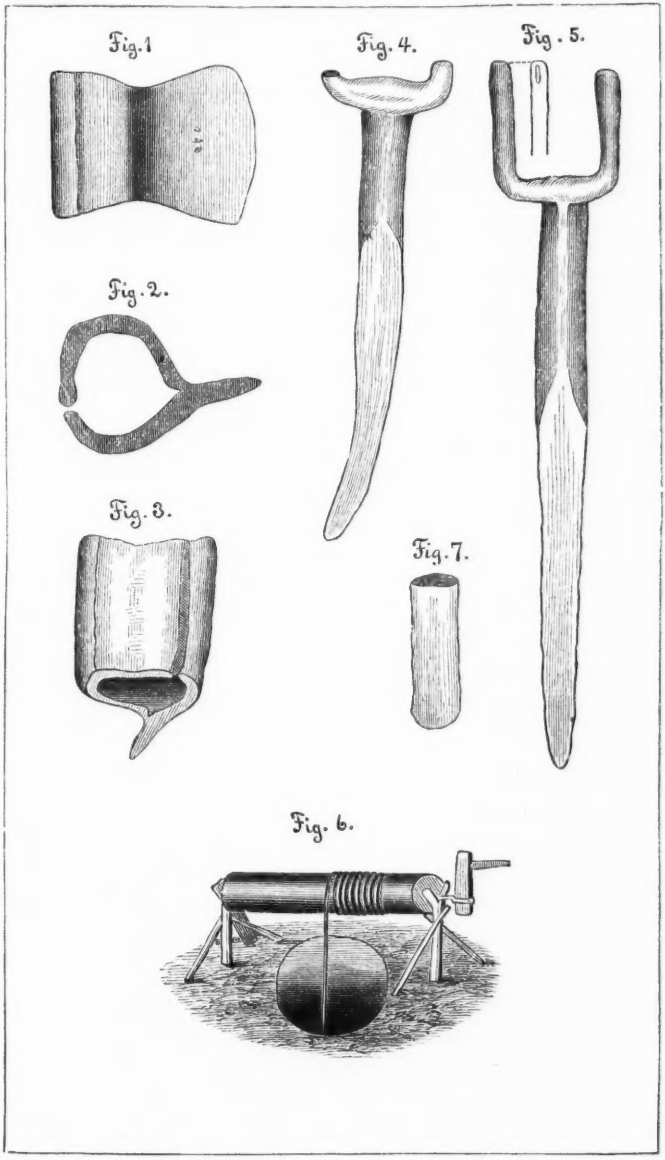
For the Finding of Mica ornaments in mounds see Vol. I, Smithsonian Contributions to knowledge. Monograph of Squier and Davis, p. 240; and Foster's Prehistoric Races of the U. S., p. 191.

[2] Speeches and Writings of Hon. Thomas L. Clingman, p. 130.

[3] See Ib., p. 131.

[4] Since the above was written Prof. Kerr has called my attention to the fact that an iron crank was discovered some years since in an ancient shaft in Cherokee county, on Valley river. See Rept. of Progress N. C. Geol. Surv., 1869, p. 56.

PLATE I.




Ancient Iron Mining Implements in North Carolina.

within it, at distances varying from thirty-five to fifty feet below the surface, were found the iron implements figured in the accompanying plate. At the depth of forty feet an adit or tunnel was found opening on the mountain side, and at the bottom of the shaft (fifty feet), resting upon quartz, the charred remains of wood. It is thought that fire was here used for the purpose of breaking up the quartz; that after the rock was heated, water was poured upon it causing it to split into fragments. Now as to the implements. They are of wrought iron, and of such shapes and weights as to be easily carried. That they had been worn out and thrown away is not improbable. The axe (Fig. 1) is rather small, and has been considerably distorted by hard usage, as will be seen in Fig. 2. The eye is quite large, and the head is cracked completely through (Figs. 2 and 3). There is also a rupture near the blade as if the strain on the handle had been so great as to almost break away the side. On the blade is a brand (Fig. 1) which has been so effaced by erosion as to be no longer intelligible. The shape of this axe and its light weight are in contrast with those in use—being of an old pattern which is now rarely met with. The blade and head are each about three and three-quarter inches in width, while between them the width diminishes to two and three-quarter inches.

The implements represented in Figs. 4 and 5 are evidently a pair of gudgeons—parts of a windlass. They are pointed at their extremities that they may be driven into a wooden roller or axis. The lower part of the shank is squared so as to prevent its turning in the wood, while the upper part is cylindrical, forming an axle for the support of the roller. Into their bifurcated heads were undoubtedly inserted levers for turning a windlass. As these irons have a length of but sixteen or seventeen inches, they could be easily carried from place to place, and the machine of which they form a part, could be readily extemporized from the trunk and branches of a small tree. Fig. 6 is theoretical, showing their probable use.

A wedge three and three-quarter inches long and one and a-half inches wide, was also found (Fig. 7). Its head was somewhat battered.

The inference to be drawn from the discovery of these *iron* relics, is, that some of the "old diggings" are the work of Europeans, as the use of iron was unknown to the native American

races. Is it not possible that there is a basis of truth in the old Cherokee tradition? That a party of Spanish explorers—and perhaps more than one—penetrated Western Carolina in search of gold, silver and other minerals, and, in some instances, finding the old mines of the Mound-builders, caused preliminary investigations of their value, does not seem improbable. In Cherokee county are found "prospect holes" excavated with far greater skill than that of savage or barbaric miners.[1] To what expedition these Europeans belonged, is a mystery. That of De Soto, according to the course traced out by Bancroft, passed within a comparatively short distance of North Carolina—especially the south-western corner—as it crossed from the head waters of the Savannah or Chattahouchee to those of the Coosa. From it an exploring party was sent to the north, which returned disheartened—without the precious gold—reporting the mountains impassable.[2] Could the work have been done by stragglers from this or other parties, or have there been special expeditions to this region of which the historian has lost sight?

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## ON THE FERTILIZATION OF CALAMINTHA NEPETA.

BY WILLIAM TRELEASE.

DURING the past summer my attention was several times drawn to this little plant, in the vicinity of Washington, by the large number of insects collected about the flowers, and a more careful examination revealed the following facts about the species.

The stem, leaves, calyx and corolla are furnished with a fine pubescence, which may prevent small and undesirable insects, like ants, from wandering over the plant, for a coating of this sort often proves insurmountable to these tiny creatures. In the throat of the persistent calyx is a whorl of stiff hairs that may serve as a protection for the young corolla and the essential organs before they are protruded from the calyx; and after the

[1] One of the most remarkable of these is a *timbered shaft* 100 feet deep on Valley river. See Rept. of Progress Geol. Survey N. C., 1869, p. 56.

[2] History of the United States. Bancroft. 13th edition. Vol. 1, pp. 47–48.

corolla has fallen away, the maturing ovary may likewise, perhaps, be protected against certain enemies.

A well developed fleshy outgrowth of the receptacle secretes an abundance of nectar which collects about the ovary in the lower part of the flower.

The lower lip of the corolla, near its base, is sparsely beset with long, stiffish hairs (*h*). Two large purple spots on its middle

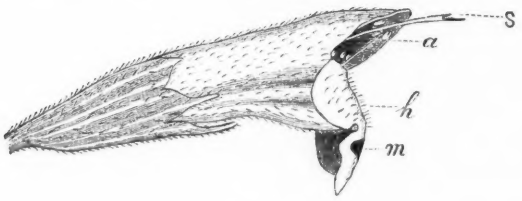


FIG. 1.

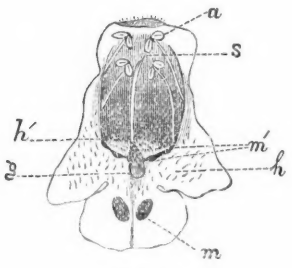


FIG. 2.

FIG. 1.—Old flower of *Calamintha nepeta*, seen from the side. FIG. 2.—Younger flower from in front. The figures are enlarged seven diameters; *a* indicates the anthers; *g*, the guiding groove; *h*, the protecting hairs of the lower lip; *h'*, the ridges of hairs bordering the guiding groove; *m* and *m'*, the nectar marks; *s*, the stigma.

lobe and close to the median line (*m*), and several smaller ones (*m'*) at the mouth of the corolla tube, clearly indicate the way to the nectar concealed within, while a deep guiding groove (*g*), bounded on either hand by ridges of stiff hairs (*h'*), leads directly beneath the four anthers (*a*) that converge in pairs close beneath the upper lip of the corolla.

On the expansion of the flower, the anthers shed their pollen. At this time the style is of such a length as to bring the stigma into the middle of the quadrilateral whose angles are occupied by the anthers, but its two lobes (Fig. 2, *s*) are now closely pressed together, and immature. In this stage the flower is, therefore, staminate, only, as regards function. After the unfolding of the corolla, the style gradually elongates and its summit passes close below the outermost pair of anthers, even brushing them in many

instances; but very little pollen seems to be carried away by the still appressed lobes of the stigma. When the latter has become somewhat exserted (Fig. 1, *s*) its lobes expand, and are now ready for fertilization, and as some pollen still remains in the anthers, the flower is now properly hermaphrodite or perfect. The stigma, however, retains its freshness for some time, and meanwhile the remainder of the pollen may have been removed, leaving the flower pistillate in function.

If, now, an insect in search of nectar is attracted to the flower, the purple blotches or nectar marks catch its eye and lead it directly to the mouth of the corolla, its head or back usually coming in contact with the receptive face of the stigma if this is already mature. The dense *chevaux-de-frise* of hairs, however, prevent it from entering unless it be large enough to effect the transportation of pollen in return for the food obtained; but if sufficiently large and strong to pass these, and not too large to creep into the flower, it enters, finding it far easier to follow the guiding groove than to pass over the bristles on either hand. Pushing in a sufficient distance to obtain the desired food, its back rubs against the anthers, or what is equally effective, its sides shaking the filaments, bring down a shower of pollen. Having exhausted the supply of nectar in the first flower, it flies to another, then to a third, carrying pollen from one to the other. Several species of Halictus[1] and *Calliopsis andreniformis* Sm., were seen to visit the flowers in this manner.

If, on the other hand, the insect be too large to force its way into the corolla, it alights on the lower lip, usually clasping the side of the tube with two or more of its feet, and thus steadying itself, while its head is thrust into the flower as far as possible, and its tongue is extended to reach the nectar. Though the *modus operandi* is different, the result is the same as in the last case, with an exception which will be mentioned later. The flowers are visited in this way by the following insects: Hymenoptera—*Apis mellifica* L., *Bombus virginicus* Oliv., *B. fervidus* Fab., *Xylocopa virginica* Drury (♀ and ♂), *Megachile brevis* Say, *M. latimanus* Say, *Anthidium cognatum* Cres., *Ammophila vulgaris* Cres., *Bembex fasciata* Fabr., and *Myzine 6-cincta* Fabr. Lepidoptera—*Colias philodice* God., *Pieris rapæ* L., *P. protodice* B. and L., *Papilio asterias* Drury?, *Junonia cœnia* B. and L., *Hesperia hobo-*

[1] The Hymenoptera were all kindly identified by Mr. E. T. Cresson.

*mok* Harris?, *H. tessellata* ?, *Lycæna comyntas* Harris?, and two species of Nyssoniades. Coleoptera—*Chauliognathus pennsylvanicus* DeGeer. In addition to these a fly, *Mesograpta marginata* Say.,[1] and one of the species of Halictus mentioned above, were found in considerable numbers collecting pollen from the anthers of young flowers, in doing which they undoubtedly often carry the pollen of one flower to the stigma of another.

Of these insects the species most common in this connection are *Apis mellifica*, *Bombus virginicus* and *Chauliognathus pennsylvanicus*, all of which may be counted by thousands on a bright sunny day about the first of September in places where the plant grows abundantly; and it is upon them, chiefly, that the fertilization of the flowers is dependent. Some of the Lepidoptera, especially *Pieris rapæ*, are very often seen sipping the nectar of the basil thyme, but from the length of their proboscides they can easily reach the bottom of the corolla without inserting their heads into its throat, and I am inclined to believe that their efficiency in the transfer of pollen is not very great. A noctuid moth, apparently belonging to the genus Prodenia was also very abundant, but in obtaining the nectar it did not rest upon the flower like the species enumerated above, but hovered before it, steadying itself with its fore feet as I have seen *Heliothis armigera* do when feeding upon the involucral nectar of Gossypium. Though I was somewhat surprised to find a noctuid thus engaged at midday, I find that Harris[2] records the habit as not uncommon to certain Agrotids, and it is probably well known to all entomologists.

From what precedes, it may be seen that the nectar of this Calamintha attracts many insects belonging to a considerable number of species, and that the majority of these—in individuals if not in species—readily obtain the sugared fluid, in doing which they encounter the stigma and anthers of the flower—the former (if mature) in entering, the latter before leaving it.

The development of the flowers is such that the self-fertilization of a given flower appears possible in but two ways: 1. Pollen may be taken up by the longer (lower) lobe of the immature stigma as the latter passes below or between the anthers during the elongation of the style, and remaining there, and

[1] Identified by Mr. Edward Burgess.

[2] Insects Injurious to Vegetation (Flint edition), p. 441.

retaining its virility till the stigma matures, it may then emit its tubes and fecundate the ovules. 2. An insect dusted with the pollen of a flower may revisit the same flower, leaving some of its burden on the stigma; or it may possibly deposit freshly gathered pollen on the stigma as it leaves the flower, but from the position of the stigmatic surface this is not likely to happen. Ordinarily, however, any flower will be fertilized by pollen from another, though from the irregularity with which insects visit the flowers of these straggling plants, this is as likely to belong to the same stock as to a different one.

In closing, it may not be out of place to offer a brief comparison of this species with others of the large family of mints to which it belongs. In this order, nectar is usually secreted—as in the present instance—by a prominent gland that, closely adjoining the ovary, is usually more or less prominently four-lobed, portions of it filling the angles between the lobes of the latter organ. Proterandry, or the maturity of the stamens before the pistil, is the rule, and is sometimes correlated with motions, due to the growth of the parts, by which the anthers and stigma at maturity successively occupy the same place with reference to the other parts of the flower. In some cases strongly marked proterandry, leading to invariable cross-fertilization, has caused the origin of forms with smaller flowers in which the anthers are entirely abortive, so that the species becomes gyno-dioecious. This is the case, for example, with the related *Calamintha clinopodium*.[1] But a careful examination of the species under discussion did not reveal a similar peculiarity in this case, though further observation, and especially over a more extended territory, may, perhaps, reveal something of the sort. According to Dr. Müller, l.c., *C. clinopodium* is visited for its nectar by two lepidopterous insects, *Pieris brassicæ* L., and *Satyrus hyperanthus* L.; and *Calamintha acinus* is visited for nectar and pollen by the hive bee, and for nectar by a bombyliid fly, *Systeochus sulfureus* Mik. From the floral structure of the basil, which is quite common in parts of our own country, one would expect its most frequent visitors to be Hymenoptera, and this is supported by what we know of the visitors of *C. nepeta*; and if so, it is probable that careful examination where numbers of the plants grow in company will reveal the hive bee as among the more frequent.

[1] Dr. H. Müller, Befruchtung der Blumen, 1873, p. 325.

# COMPARATIVE NEUROLOGY.

BY S. V. CLEVENGER, M.D.

WHAT can we say of the nervous system of Protozoa, but that it exists in a diffuse undifferentiated state? If we speak of a nerve force it implies the existence of a nerve, and herein we have the mystery explained. I do not believe in a nerve force after the general acceptation of the term, as a sort of aura residing in and produced by nerve cells. Let us see how much a reconstructed view will account for the hitherto unaccountable. There are certain natural "forces" or vibrations of matter, called sound, heat, light, electricity, etc. Expose albumen to the influence of any or all of them and determinable motions are produced in its mass. Protoplasm has a definite molecular composition which never fails to be susceptible to these influences. The contractile phenomenon is not a whit more of a mystery than the beautiful laws of electrodynamics as deduced by Ampère from the fundamental experiment of Œrsted: I. *Two currents which are parallel, and in the same direction, attract one another.* II. *Two currents parallel but in contrary directions, repel one another.* To demonstrate this, one current should be fixed and the other movable. In a few words the Amœba is the medium for the movable current while its pabulum is equivalent to the fixed current which attracts the animal. I do not mean to lay this down as actually the case, for the causes of Amœbic movements are multiplex, from which, as might be expected, there would be multiplicity of changes in its sarcode. But this alone would indicate how sufficiently the laws of physical forces may some day go to explain the protoplasmic motions.

We see that all matter is mobile. The molecules of the Amœba are not force proof, and these forces would, from the very homogeneity of the mass, pass in varying directions through the animal as governed by extrinsic causes. But as soon as differentiation began, by even as simple a process as an induration of one part of the protoplasm, currents must be deflected from their former courses. Huxley considers Kleinenberg's fibers of the Hydra as internuncial, and hence the primary form of a nerve. In this case we have a contractile muscle with a nerve differentiated from, and continuous with the muscle. How has this come about?

Immediately upon the definite location of tissue which is more

susceptible to certain external influences, such tissue would quickly differentiate a portion as the path of least resistance, which would also be the most direct conductor of motions from without to the contractile part. Thus the neuro-muscular cells of Hydra appear. From the general mass proceeds the ectoderm, and from it is differentiated the nerve-muscle tissue.

The causes of this differentiation may be conceived by regarding the forms assumed by a layer of the sporules of Lycopodium and sand, when this mixture is subjected to vibrations coarse enough to affect the layer. *The electro-dynamic law which draws together matter transmitting currents in one direction would of itself construct a nerve path to contractile tissue.*

A nerve, then, is internuncial only, and the ganglion cell is histogenetic. Neither have any force-producing power, but are both the media through which certain molecular vibrations are most swiftly transmitted.

*The primitive sense is tactile and all senses have proceeded from its differentiation.*[1] For illustrative purposes let us consider energy as divided into molecular vibrations, from one ethereal pulsation in an eternity, to an infinite number of vibrations in one second. In such an undulatory series we may see, as a small division of it, all forces from sound to gravitation represented. While the protozoön may be visibly affected by every such undulation, the homogeneity of its composition prevents any differential response; for instance, the tremor of a musical note, heat, light, electricity, alike produce contractions or expansions (motions) of its mass. In a higher form of life nerve tissue appears, which conveys only certain vibrations and rejects all others. Take one undulation in a second as the capacity of this nerve fiber. It is a tactile nerve. When a nerve fiber conveys more rapid undulations differentiation begins. Sixteen to forty thousand per second begin and end the auditory vibrations. Quicker vibrations to four hundred and fifty billion per second we may view as heat appreciation, thence to eight hundred billion from red to violet light, above this fluorescent undulations, "chemical energy," electricity, to infinity. We may thus mathematically conceive an

[1] In a paper read before the American Association for the Advancement of Science, Boston, August 28th, 1880, published in full in the Journal of Nervous and Mental Disease for October, 1880, I treated this subject more with reference to the microscopic anatomy of human nerve systems. Extracts, as above, made from that paper are such portions as refer more directly to our present subject.

auditory sense derived from the general tactile or a special touch sense (like that of the fifth pair of nerves). An optic sense would arise from this same tactile, and we have seen it thus differentiated embryologically.

*Qualitative differentiation of the nervous organization proceeds dorsally, with a tendency toward the head end.* That portion of the animal which stands in most direct relation to the changing molecular movements of the environment develops the highest sensory and motor nerve-centers and projections.

*Repetition of parts of a system, up to a certain point ceases; and these parts become commissurally united before another system is perfected.*

The sympathetic nervous system, consisting of the intestinal and vascular or vaso-motor nerves, develops first. Blending the results of comparative embryology and anatomy, the sympathetic precedes the creation of other systems.

The second system to appear phylogenetically is the spinal, equivalent in the Invertebrates to their "cerebral" ganglia.

The third system is the intervertebral, the swellings upon the posterior roots of the spinal nerves.

*The cerebellum is formed from fused hypertrophied intervertebral ganglia.*

Many sensory cranial nerves pass through this organ and by the fusion of these originally separate centers coördination occurs necessarily.

Excessive development on the one hand, or want of development on the other, places all the ganglionary tubercles and lobes of the encephalon in the third system category. Thus *the præ-frontal lobe of the cerebrum, the occipital and temporal lobes, the olivary body, the olfactory lobe, the mammillary eminence, the epiphisis cerebri, the tubercula bigemina, the petrosal and Gasserian ganglia were originally intervertebral ganglia*, and still maintain resemblance to these ganglia in many particulars.

*The præ-frontal lobe is the last intervertebral ganglion to develop.* It grows larger in the scale of intelligence and presses the occipital (see the brains of monotremes and marsupials) backward, downward and forward, thus forming the temporal (or what has been erroneously termed the middle) lobe.

The cerebro-spinal nerves, in some cases, preserve their original projections from and to muscles, but these nerves may also have

not only a distribution to the viscera, as has the pneumogastric, but may also project into and from *other system-centers.* The lateral columns of the spinal cord, the tegmentum and crura cerebri in their main mass may thus be regarded as cerebro-spinal nerves of the highest series, having lower system-centers for peripheries. The præ-frontal lobes thus exert an inhibitory control over the highest centers, because such centers are peripheries for the nerves of these foremost ganglia.

We accept the motions of protoplasm as evidence of life, and yet ungrouped elementary atoms are subject to the play of physical forces, which become known as modes of motion : sound, heat, light, electricity, etc., through the changes in place of atoms and molecules.

Inasmuch as sensations have for their ultimate expression motion in the living organism, cause and effect exchange places in the recognition that forces are manifest to us as sensation only in the molecular movements caused by forces. These molecular movements impress us as sensations which, of necessity, must be translated into some form or forms of motion.

Sensibility and motility, then, are sequentially convertible terms, and we find it none the less true in the most complex than in the simplest forms of life.

There are certain fundamental considerations which should stand in axiomatic relation to all biological inquiries.

1st. Sensibility and motility are merely afferent and efferent terms to express the effects of force upon matter and matter upon force.

2d. In life a primary object of motion is for procurement of food.

3d. Growth depends upon proper nutrition (ingestion).

4th. Multiplication (as fission) proceeds from growth.

5. Food is any material, gaseous, liquid or solid, which tends toward nutrition of the body.

6th. " Development is a process of differentiation by which the primitively similar parts of the living body become more and more unlike one another." (Von Baer.)

7th. " Higher sensory organs are special elaborations with one special function capable of response to stimuli of one special kind. They are developed from the lower kind of sensory organs, and oftentimes still possess the essential structure of that lower kind." (Gegenbaur.)

As illustrative of undifferentiated faculties it may be mentioned that by the Gregarinæ food is taken in by endosmotic processes at the surface. Any place in the protoplasm can act as a digestive cavity by enveloping and absorbing nutritive matter.

It is the simpler view, entertained by some (in opposition to the delamination precedence theory), that the form which preceded the gastrula was a one-layered vesicle which, by invagination, produced the endoderm from the ectoderm. While the ectoderm was undifferentiated, all parts of the cell were assimilative. In the gastrula stage the endoderm acquired specific ingestive faculties. Differentiation of the purely ingestive proceeds thus from the intestine, while the ectoderm remained in contact with the more variable conditions of the environment, and developed the greatest qualitative sensory and motor organs. The entire nervous organization, in its earliest condition, answers to that portion which, in Vertebrata, presides over the vermicular motions of the intestines, and the correlated respiratory and circulatory structures—the sympathetic nervous system. This, therefore, we may entitle the First System. As soon as the enteron is created, by folding in of the ectoderm, qualitative development of this First System is restricted to such functions as are more clearly nutritive, as, when the blood vascular system is differentiated from the mesoderm, the vaso-motor nerves are derived from or added to the sympathetic, and exactly in the ratio of development of the viscera so does the First System differentiation proceed.

In high forms of Invertebrata, but more pronounced in Vertebrata, the viscera, and consequently the First System of nerves, occupy an inferior position, properly termed ventral, while as a broad rule the upper surface of the animal comes most in contact with varying molecular motions of the outer world. Hence, we may say that it comes to be a law, that from the dorsal to the ventral parts of the animal, ingoing impressions proceed, and, of necessity, progressive development must occur, by superimposition upon the ventral system.

The first appearance of a Second System, equivalent to the spinal cord (segments coalesced) of Vertebrata, is indicated in ganglionic enlargements upon the afferent nerves of the First System.

This is apparent in the oyster, whose anterior ganglia (A) are placed upon the fibers leading to the principal ganglion of the

body. (In a typical embryonic, not phylogenetic sense, for the oyster is a degraded Lamellibranch.)

This appears to be a specialization of the tactile sense, with reference to its uses anteriorly in food discrimination and ingestion, involving ciliary prehension and control of the valves. In Pecten further quantitative development of a Second System produces the pedal ganglion (C), also related to the touch sense.

The cilia of Protozoa subserve ingestive as well as locomotor purposes, and show the relationship of ingestive and general motions, and that the locomotor ability is often derived from the prehensile ingestive. In the free Rotifer this is quite apparent.

As the segments increase the sub-œsophageal ganglia multiply; the first set of ganglia become relatively ventral and preside over nutrition, while the second set, relatively dorsal, indicate progressive differentiation, as control of a pedal extremity or some special organ related externally. At the same time this dorsal ganglion is connected always with the ventral system. Fusion of these segmental ganglia with each other, or with ganglia of other systems, produce confusing appearances. This fusion of systems is most clearly seen in Vertebrata.

The vibrating molecules which produce the undifferentiated impressions upon lower Protozoa may be considered as causing purely tactile excitation. Just as the waves that dash the primitive animal about differ from the ripples that bring it food, only in degree, so the differences between impressions must be regarded. All sensation being related to molecular motions, and all special sense organs being derived from indifferent primaries.

Otocysts in their simplest form are connected directly with nerves, as are the pigment granules which eventually develop into eyes. Prof. Alf. M. Mayer shows that the fibers of the antennæ of the male mosquito vibrate sympathetically to the notes of the female mosquito, and that the vibrations of the insect's antennæ may teach it the direction of sounds (thus allying this sense to

the so-called "space sense" of the human labyrinth). Prof. Mayer also announced that the terminal auditory nerve-fibers vibrate half as often in a given time as the membrane of the tympanum and the ossicles.

In these instances there is a direct derivation of an auditory from the special tactile which, in turn, was evolved from the general tactile sense, and does not seem to be lost, even in man, as a property of sensory nerves.

A heat sense system of nerves developed from pigment terminals, by further elaboration could become ocelli and finally eyes.

A special series of nerves for heat appreciation would have necessarily *a general distribution throughout the body*, to viscera as well as to more external peripheries.

Nervous tissue appears at the same time as muscular, and affords a better path or course of less resistance for the molecular vibrations from without. The muscular is a definitely located expression of what previously belonged to all parts of the animal, contractile ability or motility for assimilative purposes.

This assimilative faculty is essentially prehensile, and in the word prehension we may grasp the idea of a differentiation of such faculties as respiration, locomotion, deglutition, etc.

Carrying the comparison from Protozoa to man, all that man does or may hope to do has for its basis the single fundamental, though widely differentiated faculty of prehension.

Jaws and arms are prehensile, clearly. Ribs are prehensile in the sense that they assist in prehension of oxygen (food) for the lungs, morphologically and less physically in man, while in Ophidia the ribs are locomotory prehensile, direct.

Legs are prehensile directly in quadrumana, and in man in carrying him over ground in search of food.

As mentioned, the next step in development of the nervous system is when the ingoing general impressions become specialized and a secondary ganglion appears upon a sensory strand of the primary, which signifies that from among the general impressions some one sense, as sight, is being specialized. This is outwardly evidenced by formation of ocelli or eyes (leech), which require a special projection.

By quantitative increase multiple eyes may form (leech) and these become united into bilateral organs (pyramidal fusion in crayfish).

The likeness between the chain of ganglia in the leech and the spinal cord of Vertebrata has led many comparative anatomists astray in homologizing. A nearly similar chain of ganglia obtains in Vertebrata but situated ventrally from the vertebral column. This chain is a first system. The head ganglion, only, of the leech, as in most Invertebrata can be compared to a spinal. In Insecta and Myriapoda the superimposed secondary becomes more evident. An "unpaired system" runs in the median line between and connected with the paired or primary system, typifying the more definite appearance of the medullary gray and its commissures below or back of the head.

Todd and Bowman (pages 611 and 614, Vol. III) use the following words, which indicate an early recognition of the anatomical fact without their having seen its connection or full import: "In the bee the cerebral ('secondary') ganglion is very large; from its anterior portion is given off two nerves which pass forward to the base of the antennæ and have their origin well marked by a distinct ganglionic enlargement!"

Todd dwells upon the importance of recognizing this distinct ganglionary enlargement, and repeats, "The sensory nerves have ganglionic enlargements in the bee."

(This appearance of a third system is rare in Invertebrata, though the crab and Pterotrachea also may prove to be its possessors.)

The ganglionic swellings which on the sensory nerves of the bee distinguished it from most Invertebrata, in vertebrate types from Cyclostomes upward become more markedly developed.

While both the first and second systems possess recognized afferent and efferent fibers, before being able to comprehend the relationships between systems or the process of projection formation, we must consider whether some fundamental law does not underlie these series of relations which will better account for their creation.

The typical segment is an animal whose nerve center lies midway between an afferent and efferent strand, thus: $\frac{|}{o}$. A series of such segments, if ununited, present this appearance:

These segments could be correlated by a second fiber, which

instead of passing between peripheries as in the instance of non-union, unite the segmental ganglia by making another ganglion its motor projection.

Carpenter ("Principles of Comparative Physiology," p. 642) expresses this view: "When different organs are so far specialized as to be confined to distinct portions of the system, and each part consequently becomes possessed of a different structure and is appropriated to a separate function, this repetition of parts in the nervous system no longer exists; its individual portions assume special and distinct offices, and they are brought into much closer relationship to one another by means of commissures or connecting fibers, which form a large part of the nervous system of the higher animals. It is evident that between the most simple and the most complex forms of this system there must be a number of intermediate gradations, each of them having a relation with the general form of the body, its structure and economy, and the specialization of its distinct functions. This will be found, on careful examination, to be the case; and yet, with the diversity of its parts as great as exists in the conformation of other organs, its essential character will be found to be the same throughout."

Segmental union, thus, is accomplished through efferent nerves no longer penetrating to primary organs, but passing to nerve centers of other segments, for the purpose of producing coördinated movements, and consequently to exert an inhibitory effect thereupon.

[*To be continued.*]

——:o:——

## BOTANIZING ON THE COLORADO DESERT.

BY EDWARD LEE GREENE.

II.

BETWEEN Coyote Wells and the next station lie some twenty-two miles of almost uninterrupted plain. The white clay soil, strong with salts and alkalies, produces no cacti, but there is great abundance of chenopodiaceous shrubs, popularly called grease wood. Yet there is no verdure even here; for although the grease bushes, contrary to the rule of desert growths, are leafy, their abundant foliage is of precisely the same dull whitish color as the clay in which they grow. Over this smooth and slightly yielding clay the walking was very easy, and I made

good time, for as the objects of interest on this particular day's march did not promise to be numerous, I intended to shorten as much as possible the hours of inevitable suffering from thirst.

During the first half of the day a mirage, like a narrow sheet of placid water, just far enough away to dazzle and pain one's eyes, kept always its allotted distance ahead. By the wayside and over all the plain, were scattered the shells of a certain fresh water mollusk of the genus Unio. The nearest stream is the Rio Colorado, full a hundred miles distant, and these shells, now more than half dissolved and crumbling into scaly purple fragments when you touch them, must have been deposited here at a time when the Colorado had flooded the whole desert. No flower or bird or insect were seen to-day to vary the monotony or break the silence. At noon I detected the shape of an adobe hut upon the tremulous horizon away to the left of the stage road, probably a mere ruin, but nevertheless suggestive of water, since no one ever built an adobe wall in this wilderness without first having found water. The first impulse was to turn aside and visit the spot. But as, through the varying medium of the heated air, the adobe at one moment seemed near, and the next very far off, so that I could not guess whether it was one mile away or five, I at second thought resolved not to waste time in what might prove a long and worse than fruitless deviation from my proper course. Before the afternoon was half gone my twenty-two miles journey was ended. I had reached the station of Indian Wells. The third day's travel witnessed another change in the character of the soil. The ground becomes sandy, and instead of the grease wood of the alkali flats we have the much more sightly creasote bush (*Larrea mexicana* Morie), a bright evergreen with small foliage somewhat resembling that of the dwarf box, though the shrub has nothing of the close, compact habit of the box, and its slender spreading or rather drooping boughs bear yellow blossoms among the leaves.

The twigs when bruised exhale a strong odor of creasote, and they have stimulating properties. The Indians and Mexicans journeying across these parched wastes, chew them, and even tie bunches of them to the bits in the mouths of their ponies with good results in cases of extreme suffering from fatigue or thirst. This shrub occupies the sandiest parts of the desert, and usually where it occurs no other species of vegetation is found.

After some eight or ten miles of sand came another change of soil, and the creasote bushes gave place to the mezquit, a small tree of considerable importance in the Southwest. This was the first mezquit wood I had ever seen; I therefore turned aside from the road to walk among the trees, wishing to inspect somewhat carefully the characteristics of the species. Very suddenly my attention was called to certain objects interesting in quite a different way. The noonday silence was broken by a shout, and turning toward the quarter whence the voices had seemed to emanate, I discovered a dozen naked savages, some standing, others sitting under a mezquit tree. After a little experience of travel in Western wilds, one learns not to be always afraid of Indians; yet I confess on this particular occasion a full inventory of the traveler's feelings might have shown some fears. I was alone, unarmed, and at a rather unsafe distance from any habitation of civilized men. If the barbarians should, for any purpose, see fit to make away with the defenceless saunterer, and put his bones to rest beneath the sands, they could do so with perfect safety to themselves. They were stalwart fellows, quite different in appearance from the members of any Western tribe with which I was familiar; moreover they had displayed unusual boldness in their yelling out and commanding me, as they did by word and gesture, to leave my own course and come and pay to them my respects. But whoever upon finding himself in the power of savages feels any timidity had best conceal it. I, therefore, with an air of calmness and confidence marched forward and seated myself in the sand in the midst of the swarthy group. For a while no one spoke. Indeed, their knowledge of the learned languages was presumably not much more extensive than mine of the dialect of the Yumas. But the Yumas have inquisitive eyes, and they studied their visitor in silence. Presently the oldest looking one among them discovered something which evidently interested him. It was a plain heavy ring, rather specially valuable to me as having been made from a nugget of Australian gold which a friend from that far off southern coast had given me. The Indian pointed to this and asked if it was "oro."[1] Feigning a confidence which I was far from feeling, but judging it the wisest thing to do under the circumstances, I slipped the ring from my finger and passed it over to him. He placed it upon the

[1] Spanish for gold.

palm of his hand and gave it a slight toss in the air, thus testing to his own satisfaction its weight and genuineness. Each one of the speechless company went through the same performance, and then the ring was handed back to me by the one who had first received it, greatly to the quieting of my nerves. And now my botanist's portfolio had to be examined. It was well filled with flowers, and boughs and twigs of desert bushes, with which my interviewers were familiar. They all gathered close about me to admire my herbs, and then entered into conversation among themselves, discussing, I dare say, the question of my object in gathering up these things. They gave me their names for certain of the plants and then inquired what I called them. Presently he who seemed the chief man among them expressed to me his opinion that I was a "medico," and I felt that I was safe. Composedly I now surveyed the persons of these representatives of a tribe that was new to me. In appearance they were the least repulsive of all the Indians I had ever seen. Every one of the party must have measured at least six feet in height; and clad only in their breech clothes, each displayed a development of form and figure well nigh faultless. Their faces, too, really bore an expression of mildness and good humor not commonly noticeable in aboriginal Americans. In short, I beheld for the first time a group of rather handsome Indians. What their business may have been here in the midst of the desert, so far from their homes on the fertile banks of the Colorado, I cannot guess.

To-day the distance from station to station was thirty-two miles. Happily for the pedestrian there is a well mid-way between the stations. This place of refreshing was arrived at within a half hour after I had concluded my visit at the encampment of Yumas. It is called New River Well; not because there is any river there or ever was. There is, however, a broad and shallow channel where once, since white men began to traverse the region, there flowed for a few hours a broad and turbid stream. Though the flood was transient, and no one could tell whence it came, the fact sufficed to give the place the name of New River. A deep well has been sunk at this point by the stage company. The water, though clear and cold, has such a sweet, nauseating and rather metallic taste that no one drinks of it unless impelled by most inordinate thirst; however, it does not seem to be at all unwholesome. There is no describing the almost maddening thirst which

is excited by a half day's walk under a scorching sun in this excessively dry atmosphere; but from the incredible quantity I drank of this water, so offensive to the palate, I suffered not the slightest inconvenience afterwards.

From New River we pass forth again to a dreary stretch of sandy waste. Heaps of white bones half buried under sand drifts by the wayside, mark the point where years ago a large herd of beef cattle perished in the attempt to drive them by this road from the rich grassy valleys of Sonora to the commanding markets of the Californian coast. The afternoon heat was intense, and one felt more than willing to pause and rest a while as often as one found a creasote bush tall enough to give a little shade. Owing to the several delays made during the day, the deep evening shadows, as they fell, found me some miles from the station; but the road being clearly traceable, there was no danger of missing one's way, and the walk by starlight, in the cooler air, was not unpleasant. As I entered now another belt of low mezquit wood, the light evening breeze came laden with delightful perfume very much like that of pond lilies. But for the loose, dry, yielding earth beneath my feet I could, in the darkness, have fancied myself near the margin of some far northern lake in June, when thousands of those queenly flowers rest on the bosom of placid waters, and breathe "sabean odors" on the air of night. From thoughts of distant lands, and memories of "days that are no more." I was called back to the present by the significant and just now not unwelcome sound of a bull dog's bark, announcing the proximity of my place of shelter for the night, or at least of what I had looked forward to as such; but in fact, this one particular station, when reached, appeared so filthy and ill kept that I was loth to accept a lodging under its roof. After supper as I sat outside the door, I descried, by the light of the rising moon, some bales of hay near the stable, and, as the night air was mild, I asked and readily obtained permission to sleep on a bale of hay. Here I lay, wakeful for a long hour, watching by the moonlight the gambols of a wolf from the desert. This frolicsome beast amused himself and me by capering and yelping around the chained watch dog, greatly to the annoyance of the latter, who evidently wished himself free for a good chase or a fair fight.

In the early morning search was made for the flowers, whatever they might be, which had breathed forth such grateful incense on

the evening air. They were not soon discovered. The parched earth showed nowhere grass or herb of any sort. One cottonwood which the ranchman's axe had spared, stood fair and bright in its fresh spring foliage; but the mezquit trees, notwithstanding the high temperature of these latter days of February, showed yet no sign of leaf or blossom; the larger of these, however, seemed burdened with heavy tufts of a dark green parasite —a species of mistletoe (*Phoradendron californicum* Nutt). This mistletoe, upon a close inspection, was found bearing a profusion of small, greenish and altogether inconspicuous flowers, with precisely the fragrance of pond lilies; and so the pleasant riddle of the previous night was solved.

The fourth day's travel brought nothing new or specially interesting in the line of the botanical; but the larger size of the mezquit trees, and the more frequent occurrence of them would have indicated, even if the miles had not been counted, that we were nearing, gradually, the banks of the Colorado, the eastern boundary of the desert. And here let us notice more particularly this characteristic and most important of the native trees of the far Southwest, the common mezquit (*Prosopis juliflora* DC.). To give a general idea of the species, we will compare it with the honey locust (*Gleditschia triacanthus* L.) a tree well known almost everywhere east of the Mississippi, and not remotely allied to the mezquit. The two species, in several points, very strongly resemble each other. The leaves and flowers of both are much alike, and both have their branches armed with stout, forbidding thorns. But while the honey locust grows erect and displays a well shaped head, the massive trunks of the mezquit usually almost recline upon the ground for about two-thirds of their length; and there are commonly four or five of these half reclining trunks growing from one root; so that a good forest of mezquit, which would really, if cut down, yield a vast amount of wood, looks more like a straggling orchard of old and deformed apple trees than like what would be called a fine piece of timber. The fruit pods, borne in heavy clusters, are as long as those of the honey locust, but very narrow hardly the fourth of an inch in width, thin and flat; and instead of the sweet reddish pulp of the locust pod, the mezquit has its seeds imbedded in an abundance of a hard, white substance, very sweet, and which the chemists tell us is grape sugar in a state of great purity. Horses, horned cattle

and swine are very fond of these mezquit beans, as they are called, and fatten rapidly when fed on them. Moreover, the "mezquit meal," which Indians and Mexicans manufacture by drying and grinding these pods and their contents, is perhaps the most nutritious breadstuff in use among any people, barbarous or civilized. In these regions where no grass grows, and where the growing of the cereals is limited to the valleys of rivers that are few and far between, the importance of the mezquit, from an economic point of view can hardly be overestimated. The wood burns with an intensity of heat that is unfavorable to the nicest results in baking, and also destructive to iron; hence the few settlers on mezquit lands who brought stoves along, use any other wood rather than mezquit to burn in them, but the best of charcoal is made from it. They assure us that this species of timber possesses the singular property of seasoning without undergoing any perceptible shrinkage. Freighters and immigrants passing over these desert regions, where of course there are no such things as wagon shops for hundreds of miles together, being obliged to do their own wagon repairing, always replace the broken spoke or felly with one made from green mezquit, and the new piece does not shrink away and become loose and useless as it would if made of, for example, a stick of unseasoned oak.

Besides this common and most useful species there is another, called the screw mezquit (*Prosopis pubescens* Benth.), on account of its short pods being closely twisted into the shape of a screw. This is a smaller tree, of no importance except that its pods have the same nutritious properties as those of the larger and more common sort.

Having now become familiar with all the principal trees, bushes and herbs of the great, desolate wilderness, I was not sorry when I knew myself to be approaching the banks of the Colorado and the habitations of civilized men. During five days I had never met a fellow traveler of any complexion on the road save that gang of naked giants, the Yumas before referred to. It was therefore a new and rather pleasant species of incident that befell me when within thirty-five miles of my journey's end I met a pedestrian of my own color. It was a fair haired, handsome French boy of eighteen or twenty years, who came plodding along through the heated sands in his stocking feet, and carrying over his shoulder a pair of new boots. His brand new suit of

army blue, together with the manifestly unquiet condition of his nerves, told all too plainly the tale of desertion from the U. S. Army. His first words when we met were to ask how far it was to water. I pitied him most sincerely, for I had to answer "at least ten miles;" at which discouraging news he, however, stamped the sand in such emphatic wrath, and gave vent to such a volume of French profanity, as quite satisfied me that he was good for the ten miles even without refreshment. He had taken French leave of Fort Yuma on the Colorado early in the course of the previous night, and was now at midday full thirty-five miles out upon the desert, on his way to San Diego. Not having dared to appear before the inmates of the one station he had passed, he was now sorely pressed by thirst and hunger, and also harassed by the fear of falling into the hands of possible pursuers. When we parted he begged me not to give any information concerning him to any military party I might chance to meet upon his track; and certainly for his youth's sake, and for the courage displayed in that bold adventure of a solitary flight across this hundred miles of desert, I did wish for him a clean escape, fugitive that he was.

Twenty-four hours later this other adventurer had accomplished his undertaking; the desert had been crossed, and he sauntered leisurely and content under the cottonwoods and tall willows that make up the forests of the lower Colorado valley. It was only the twenty-second day of February, but the cottonwood trees were in full leaf and gave delightful shade. The willows, though they had not yet divested themselves of more than half their last year's foliage, were in flower. The yellow catkins were actually crowding off the leaves which had kept their places and retained their freshness during the brief frostless winter.

This belt of riverside timber is occupied by the Yuma Indians; but from the roadside no dwellings of the aborigines were apparent. One saw, however, numerous pathways which had been cut through the dense thickets leading from the road to the villages, and the voices of Indian children at their sports came ringing out from the deep shady distance. On gaining the open river bank, I saw, near the ferry, four stalwart Yumas, in their usual picturesque costume of a red and yellow striped breech cloth, lying fast asleep on the upturned bottom of an abandoned flat boat. I disturbed not their slumbers. Two Mexicans near

by interested me more; for they, observant of my approach, stood holding the oars of their rude skiff, eager to earn "dos reales" by transferring me to the opposite bank. I was not unwilling to avail myself of their services. Once on the Arizona side of the river, an hour's walk would bring me to the thriving little town of Yuma, and my five days on the desert had well prepared me to appreciate the comforts of a well kept village hotel and the society of the civilized.

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## THE METHOD OF DISTINGUISHING SPECIES OF POPULUS AND JUGLANS BY THE YOUNG NAKED BRANCHES.[1]

BY PROF. W. J. BEAL.

IT is supposed to be the aim of the botanist when he describes a plant to name the peculiarities which are the most striking and constant, especially those which are easily seen with the unassisted eye. The writer has often been surprised that the peculiarities of the pith, bark, leaf scars and buds of our deciduous leaved trees and shrubs are not more frequently given in descriptions.

For five or six months of each year most of these plants are destitute of flowers, fruit or leaves. If it is easy or possible to distinguish species by the points above named, it certainly would often be very convenient. In 1876, Frederick Brendel, of Peoria, Illinois, said:[2] "We have no surer guide than the characters taken from the arrangement, form and construction of the buds, and in many cases from the leaf scars."

I will now proceed to point out some of the differences between the species of Populus and of Juglans, as seen when the young growth is destitute of foliage. I have studied four species of Populus and two of Juglans, all natives of Michigan.

*Populus tremuloides.*—In very slender branches one year old all of the pith is green; in larger branches a green layer surrounds the pith, which is of a whitish color much resembling the wood. With a short exposure to the air the pith becomes brown.

The bud scales are polished. The transverse diameter of the

[1] Read at the Boston meeting of the American Association for the Advancement of Science, Aug., 1880.

[2] Bulletin of the Illinois Museum of Natural History, No. 1, page 26.

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leaf scar slightly exceeds the vertical diameter. Fig. 1, *a b c*, illustrates the buds and bud scars of *P. tremuloides*. The buds are not viscid. The one lettered *a* is a drawing of a portion of a

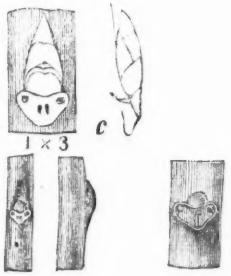


FIG. 1.

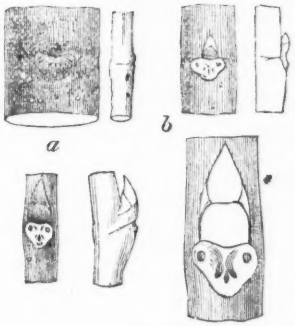


FIG. 2.

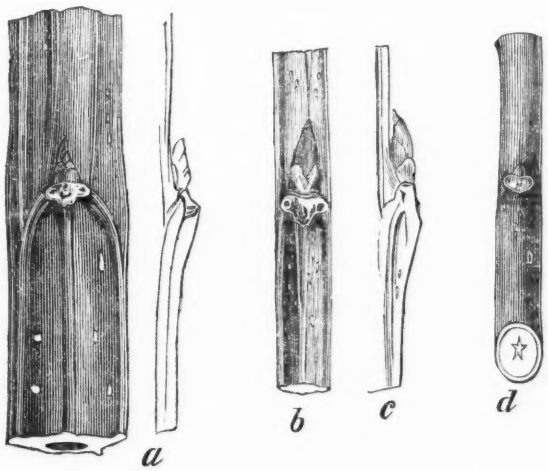


FIG. 3.

## EXPLANATION OF THE FIGURES.

FIG. 1.—*Populus tremuloides*. *a*, scar and bud near base of branch, enlarged three diameters; *b*, natural size near the middle of a rapid growth; *c*, front and side view of same enlarged three diameters.

FIG. 2.—*Populus grandidentata*. *a*, enlarged front and side view of bud and scar near the base of a year's growth; *b*, the same farther up the stem; *c*, enlarged view near the middle of stem.

FIG. 3.—*Populus monilifera*. *a*, natural size figure near the middle of a large thrifty growth; *b c*, views of middle of slender growth; *d*, view near the base of stem.

stem not far from the base of the growth of last year; the others are taken from near the middle of the same growth. These illustrations and the succeeding ones are all drawn to the same scale, unless otherwise designated.

*Populus grandidentata.*—In thrifty twigs, one year old, the pith is yellowish white; the wood greenish white. The pith in twigs two or three years old is light brown. The buds are slightly pubescent under a lens and of a grayish-brown color, not viscid. Near the middle of a branch, the leaf scars are about as broad as long. Near the base the transverse diameter is the greater. The internodes of this species in slow or in rapid growth are much longer than those of *P. tremuloides.* They are often twice as long in stems which have made the same amount of growth. Fig. 2, *a b c*, illustrates the buds and leaf scars on young stems of *P. grandidentata.*

*Populus monilifera.*—The pith is light-brown and a cross section is usually pentagonal. In most slender young branches the pith is green, changing to brown on an exposure of a few minutes to the air. The shape of the leaf scars is about midway between that of *P. tremuloides* and *P. grandidentata.* Branches which have made slow growth and the base of thrifty branches are often without angles on the surface. Thrifty young branches have from five to eight prominent vertical ridges. One of these ridges extends below the center of a bud and one runs down from either side of the leaf scar. The branches are of a yellowish or greenish-brown color. There are a few round or oval white or brown spots on thrifty stems a year old. The buds are brown, viscid, not very glossy, and are destitute of pubescence, except a little on the margins of bud scales. The buds are larger but their shape is much the same as those of *P. tremuloides.* On thrifty branches there are often some buds mixed in with those larger which are short and not fully developed. For illustrations see Fig. 3, *a b c d.*

*Populus balsamifera.*—The young branches are brown and polished. The lower buds of the season are broad and small, and the scar below is broad. The lower buds and leaf scars of these four species of Populus are much alike in shape. The buds on the middle of the thrifty growth of *P. balsamifera* are quite long, often seven-eighths of an inch. They are curved and pointed, and become viscid. Fig. 4, *a b c d e*, illustrate buds and leaf scars of this species.

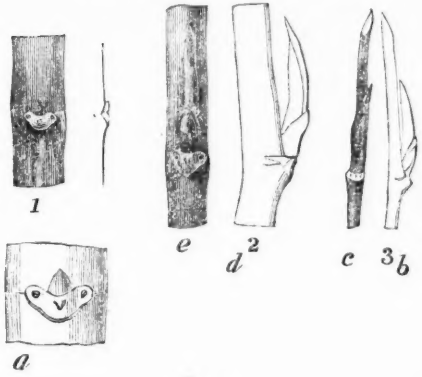


FIG. 4.

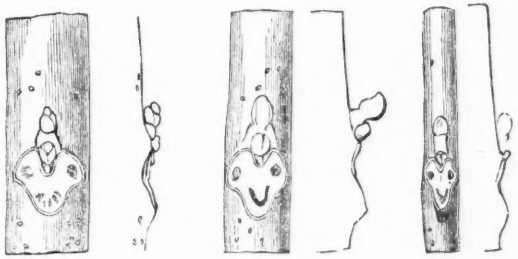

FIG. 5.

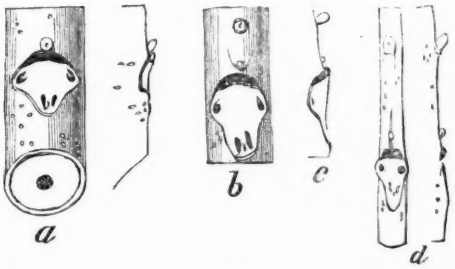


FIG. 6.

## EXPLANATION OF THE FIGURES.

FIG. 4.—*Populus balsamifera.* *a*, enlarged view of stem near the lower end; *b c*, views of middle of a very slender stem; *d e*, views of middle of a large growth of a thrifty stem.

FIG. 5.—*Juglans nigra.* A front and side view of thrifty growth near the base; *b c*, a similar view from a thrifty branch near the middle; *d*, similar views of a slender stem near the middle or top.

FIG. 6.—*Juglans cinerea.* *a*, two views of a stem near the base; *b c*, similar views near the middle of a branch, *d*, similar views of slender stems.

*Juglans nigra.*—The pith of this species consists of thin plates running transversely, leaving open cavities between them. The pith is of a light-brown color. On a thrifty branch the bud scar is nearly heart-shaped with vertical and transverse diameters about equal. A very small bud can be seen in the sinus of the scar. Above this is a larger bud, most of which is also within the sinus of the leaf scar. Above these buds is a third one, still larger. The transverse diameter of the leaf scar is about equal in length to the distance between the leaf scar and the tip of the upper bud. A side view of the leaf scar shows quite a sharp depression in the middle. On slender branches the bud scars are laterally compressed or appear longer than on stout branches. Fig. 5, *a b c d*, illustrate this species.

*Juglans cinerea.*—The pith is separated in plates. It is of a dark brown color and in a narrower cavity than that of *J. nigra.* The leaf scar on a thrifty growth is not unlike the shape of a sheep's face. The scars left by the woody bundles of the leaf are shown in the drawings of all the species above mentioned. Towards the lower part of a branch, one bud only appears above the leaf scar; farther up on thrifty branches two buds may be seen. The scar is without any sinus or depression at the top. In this species, on the middle of rapid growth, the upper bud is from one-fourth to two-thirds of an inch or even more above the top of the leaf scar. Along the top of the leaf scar is a transverse or curved ridge or crest resembling velvet or plush. This crest is not present in *J. nigra*, but is rarely if ever absent in *J. cinerea.* The bark on a thrifty branch of *J. nigra* when one year old is about a third thicker than that on branches of *J. cinerea* of the same age and size. After the first year, and sometimes sooner, the outer bark of *J. nigra* cracks and rolls up in scrolls, while the outer bark of *J. cinerea* shows nothing of the kind. Fig. 6, *a b c d*, illustrates this species.

The young trees of these two species of Juglans are not easily distinguished by the leaves. In the axil of the leaf of *J. cinerea*, even when quite young, can be seen the velvet ridge. The odors of crushed leaves of the two species are different.

Some observations lead me to believe that many other trees and shrubs can be equally well distinguished by the young naked branches, while in some cases it will be difficult to find good specific characteristics. The drawings for this paper were made by W. Holdsworth.

## AN ADDRESS TO THE FOSSIL BONES IN A PRIVATE MUSEUM.

BY JAMES S. LIPPINCOTT.

"And you have walked about—how strange a story!"
In days gone by, a million years or so,
When giant saurians were in all their glory
In the dim twilight of the long ago!
When Hadrosaurus reared his height stupendous,
And Aquilunguine Lælaps leaped tremendous!

Could ye but speak, what stories you could tell us!
How on the oozy flats you floundered free;
Elasmosaur and all his scaly fellows
That fished and paddled the Cretaceous sea,
And Mosasaurus, how he showed his tushes
Ages ere Moses boated 'mong the rushes!

That "there were giants in those days" is certain,
Not such as those by Scripture story told,
Nor known to us till science raised the curtain,
Their length and breadth and stature to unfold;
Monsters of flesh and bone and horny mail,
And jaws and claws and ponderous length of tail.

Oft have we queried, wherefore had ye birth,
And wherefore sent into a world like this
Ages ere perfect man appeared on earth?
As told in chapter first of Genesis,
Of which our Savans have not yet been able
To show how much is fact, how much is fable!

The "dark idolator of chance" may learn
A lesson pregnant from your gray remains,
See proof of plans, deep-laid, he may not spurn,
By Power Creative, through all time the same;
See glimpses of the slow evolving plan
Developing the monad up to man.

Then hail your advent to the light of day!
A revelation of old time to this,
Along the darkened past a brilliant ray
Lighting an else unfathomable abyss!
And hail to him whose skill your import can make plain,
Can reconstruct the past and make it live again!

REPLY TO J. S. L.

My dearest cousin, several times removed,
Since you have called me from the vasty deep
To witness how our race has been improved,
Pray hear my answer ere you go to sleep.

And first I hold that it is not polite,
To call relations by such horrid names
As Hadro-mosa-sauri, which excite
Suspicion of the justness of your claims.

You seem in fact to have ransacked your brains
To find some endless word to suit my bones,
I'll take some little pity on your pains,
And tell you plainly that "my name is Jones!"

And I was born so very long before
Your puny race appeared upon the earth,
That human fancy ne'er may hope to soar
Back to the bygone age which saw my birth.

That to each other we have not been known,
Is owing to your most egregious fault;
For this confounded piece of marly stone,
Has served for ages for my burial vault.

Your ancient Scripture cannot be so old
Or nigh as perfect as this mass of rocks,
In which the patient seeker may behold
Foundations of a faith most orthodox.

It is not treating me as I deserve
To end the monad series with a man,
Presumption founded on some extra nerve
Which you possess, does not destroy the plan.

Be warned in time lest overbearing pride
May be the chief occasion of your fall,
Let future beings 'twixt us both decide,
Which was the master and which was the thrall.

Farewell! my voice is now forever hushed,
No more to be evoked by prose or rhyme;
The hue of health which once my temples flushed
Has changed to that of carbonate of lime!
Farewell! at least until the end of time.

# EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— We have received the report of the Secretary of the Interior for the year ending June 30, 1880. We find contained in it a recommendation to the President of the United States in favor of the Geological Survey as conducted under its present director, Clarence King. The accompanying summary of the plan of organization of the survey, impresses us favorably, and science should reap a rich harvest were its effectiveness assured by a strong *personnel* and a proper direction of their work. The reports of progress which it is proposed to publish, will, we are informed, consist of the following twelve volumes: "Geology and Mining Industry of Leadville, Col.," by S. F. Emmons; "Geology of the Eureka mining district in Nevada," by Arnold Hague, geologist-in-charge; "The Copper Rocks of Lake Superior, and their continuation through Minnesota," by Prof. Rowland D. Irving; "The Comstock Mines," by Eliot Lord; "The Comstock Lode," by George T. Becker, geologist-in-charge; "The mechanical appliances used in mining and milling on the Comstock Lode," by W. R. Eckard, chief engineer; "The Coal of the United States," by Raphael Pumpelly, geologist-in-charge; "The Iron in the United States," by Raphael Pumpelly; "The precious metals," by Clarence King, director; "Lesser metals and general mineral resources," by Raphael Pumpelly; "The Uinkaret Plateau," by Capt. C. E. Dutton, geologist-in-charge; "Lake Bonneville," by G. K. Gilbert, geologist-in-charge; "The Dinocerata, a monograph on an extinct order of ungulates," by Prof. O. C. Marsh, palæontologist.

We are naturally impressed, on reading this statement, by the great predominance of the economic side of geology over the purely scientific, a tendency already visible in Mr. King's Report on the Geology of the Fortieth Parallel. In this work one volume was devoted to mining machinery, a subject which we claim to be foreign to the scope of a scientific geological survey. This tendency is developed to the full in the programme set before us, so that it really looks more like the prospectus of a mining engineer than a plan for the advancement of geological science. That the country does not require this kind of work to be done by the Government, is self evident, since the employment of geological and mining experts for the services apparently contem-

plated by the reports in question, is matter of every day occurrence. The United States geologist, in proposing such a scheme, has entered upon a sea of difficulties, of which he must but too soon become aware. We maintain that retention as a mining expert should be regarded as a disqualification for the position of United States geologist. The tremendous pressure of the mining interests of the country upon the occupant of that important position must be too great for any but a man exclusively devoted to purely scientific interests, to properly resist. The men for the place are devotees of science like Hayden, or engineer officers like Wheeler; men who do not know enough of the relations of fees to "expert reports," or of stock jobbing operations, ever to risk the sacrifice of their professional independence by alliance with any interest of the country whatsoever.

Mr. King's scheme represents a new departure in government scientific work, and one which we regret. It may indeed be said, that the titles of his proposed volumes are purely *ad captandum*, but from the previous history of this gentleman, we cannot accept this as a valid explanation. Hayden and Wheeler never thought it necessary in the past to suppress the claims of pure science, and they cannot complain that Congress was not liberal in its appropriations. Congressmen are indeed aware that the only function of government in the matter is to develop knowledge for the sake of all interests, and not for the sake of any particular interest. It is not necessary for the scientific men of the country to change their attitude after the successes of the past decade. But Mr. King is essentially a mining geologist, which may partly explain the various serious scientific blunders to be found in the palæontological and mineralogical portions of his report on the geology of the fortieth parallel. That the new United States Geological Survey would run into this channel, is no more than we anticipated at the time of the abolition of the old surveys, and formed one of the grounds of our opposition to the change at that time.

The proposition to extend the United States Survey over the old States is one that depends for its merit on the manner in which it is carried into effect. To relieve the several States of the responsibility of making geological surveys of their own territory would be a positive injury to the scientific interests of the country. The aggregate appropriations made by the States for this purpose must, in the end, exceed the amount which the National Government could devote to the same object. The State Legislatures ought not for a moment to be allowed to suppose that the General Government will relieve them of the necessity of looking after their own interests. But a United States Survey should undoubtedly have general supervisory powers over the entire country. It should collate the results of the State surveys

for its reports, and use their maps in making up its own. Its relation to the States should be about that of the Bureau of Education to the State school systems.

—— The adverse influence of city life on the development of young naturalists, and the great lack of active scientific societies in our larger cities, with the exception of Boston, Philadelphia, New York, Washington, Salem, Buffalo, Cincinnati, St. Louis and Davenport, is perhaps a subject worth considering.

The cultivators of natural history imbibe their early love for nature during their out-of door, early life in the country. Nearly all our leading naturalists were country-bred boys. So flourishing an organization as the Society of Natural History at Boston, counts, we believe, only two active leading members born in that city; the membership is made up largely of those brought up in more immediate contact with nature. The city naturalists are reinforced from the country. The scientific societies in the cities above mentioned are maintained largely by physicians or college professors, originally country-bred. If city life were more conducive to the growth of natural history studies, why do not such cities as Chicago, Baltimore, Louisville, New Orleans, Charleston, Savannah, Pittsburg, Providence, Worcester, Springfield, Rochester, Trenton, Indianapolis, and Portland—we select the names much at random—maintain flourishing societies? The subscription list of this magazine has always consisted mostly of those living in the Western and Middle States; it is in the smaller communities, many of them college towns or villages, that naturalists develop, though we wish we could say that they thrive there.

In the country native zeal and enthusiasm, the powers of close and prolonged observation—communing with nature—arise spontaneously on the farm and at the country-seat; transplanted into the city, country-bred naturalists can organize and build up museums and libraries and publish the results of their studies, but the original material is drawn from those who live in villages or the suburbs of the larger cities. Natural history is now extensively taught in the public schools of our cities, and much effort is thus expended to manufacture naturalists, or to induce a respect for scientific studies, but the efforts are too recent to bear immediate fruit. The exodus for two or three summer months into the country of families, now so marked a feature of our larger cities, will, we hope, in the long run bring the children of the present generation into immediate contact with nature and result in a harvest of naturalists, endowed with a simple love of nature and zeal for scientific pursuits, and the love of truth and knowledge for its own sake, which will instill a wholesome spirit into our national life.

—— We hope to be able soon to furnish some statistics as to the organization of scientific bodies in the United States. We look forward to the time when each State will have its Academy of Sciences, and it is only a question of enlightened self-interest

on the part of existing bodies, as to which of them becomes the Academy of Sciences of the State where it is situated. Of course such an institution is yet impossible in many of the States, where science is only represented by amateurs, or not at all; but in a number of them, real academies could be organized to-day. The present policy of electing gentlemen to full privileges in scientific bodies for $5 or $10 a year, must soon terminate the existence of such bodies as scientific, from natural causes; the property being thus slowly, but surely, alienated from the uses for which it was originally designed. The only American societies which are so constituted as to be self-protective in this respect, so far as we are at present informed, are the National Academy of Sciences, the Boston Society of Natural History, and the New York Academy of Sciences. The men devoted to original research in Philadelphia, Cincinnati, Chicago and St. Louis, are becoming numerous, and may be expected to follow early in the footsteps of their more enterprising predecessors.

—— The scientifico-literary critic of our esteemed contemporary the New York *Times*, has recently given his readers his views as to the AMERICAN NATURALIST, some of which are wise and some otherwise. There is a flavor about some of his remarks which reminds us of the funeral of a late scientific journal in another city, at which our critic may have been a mourner. He gives us a favorable opportunity of making a statement regarding the policy of the NATURALIST. He observes, "what it needs is a catholic management which would print articles even if the theories presented could not receive the entire assent of the editors," etc. As the NATURALIST has eight editors, more than any other scientific journal in the world, of whom five are acknowledged experts in original scientific research, an article must be very eccentric in its politics not to meet the approval of some of them. As a matter of fact, the NATURALIST will always print articles within its scope, which are accurate as to matter of fact, and intelligent in treatment, no matter what the theories of the authors may be.

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## RECENT LITERATURE.

THE NATURALISTS' DIRECTORY FOR 1880.[1]—We have before us the last edition of this once useful work. It is difficult to imagine what possible object the editor had in view in the arrangement of the contents. We cannot see how it can be of the least use to any one, as the names are arranged by States, and there is no alphabetical or subject index. A very considerable portion of the volume is occupied with advertisements, many of them

[1] *The Naturalists' Directory for 1880.* Edited by S. E. CASSINO. Boston, S. E. Cassino, Publisher.

totally foreign to subjects connected with science. The time once was when a Naturalists' Directory was a great desideratum, and the first edition of Mr. Cassino's work was valuable, but since that time there has been a steady deterioration, and it seems that at present the work has degenerated into a means of collecting an annual assessment on all the naturalists of the country for the personal benefit of Mr. S. E. Cassino.—*J. S. K.*

SHELL HEAPS IN JAPAN.—No doubt many of the readers of the AMERICAN NATURALIST observed in the issue for last September, a criticism by Prof. Morse on two recent publications on Japanese archæology. One of these publications, which is by myself, is entitled " Notes on Stone Implements from Otaru and Hakodate, with a few general remarks on the prehistoric remains of Japan." It was published in the transactions of the Asiatic Society of Japan, in February, 1880. The other publication to which Prof. Morse desires to call attention, is a handsome volume on " Japanese Archæology," by Henry Von Siebold, a gentlemen who, whilst residing in this country for over fifteen years, has for a considerable portion of this time made archæology a specialty, and accumulated materials and information, as compared with which the works of all others are but insignificant. The only other recent publication on Japanese archæology is the memoir on the " Shell Heaps of Omori," by Prof. Morse himself, a volume full of most valuable material. The conclusions which Prof. Morse deduces from his materials are probably not those which he would have arrived at had his visit to Japan been less flighty, or had he more thoroughly acquainted himself with the literature (European and Japanese) of the subjects about which he wrote. One conclusion to which Prof. Morse has come, is, that the shell heaps he describes are not those of the early Aino inhabitants of this country, but probably pre-Aino, and those who venture to put forward opinions which are contrary to his own, he evidently desires to hew and hack at until they are quite exterminated. As nearly all the workers at the archæological materials which are so profusely spread throughout Japan, have opinions which are opposed to those of Prof. Morse, the task before him is extensive. In the shell heaps of Omori, Prof. Morse has found a number of human bones, and amongst these several fragments of platycnemic tibiæ. These bones are exhibited in the museum of the Tokio University. I may remark that although I and *many* others have made numerous visits to the Omori heap and collected many basket loads of bones, we were not fortunate enough to find anything which was human. Speaking of the bones found by Prof. Morse, I remark in my paper referred to, " If such tibiæ are characteristic of the Ainos, and I am assured that such is the case, we have here another indication pointing in the same direction," namely, that the shell heaps in which these tibiæ are found, are probably of Aino origin. This quotation is

the only remark which I made in my paper upon this subject. In a challenge I am asked by Prof. Morse on what authority I have stated that the Ainos have platycnemic tibiæ, and further Prof. Morse would have me regarded as the author of such a statement.

Assuming that what I have said places me in the responsible position which Prof. Morse, by wrongly interpreting my words, is evidently desirous that I should occupy, I will say, that if Prof. Morse had acquainted himself with the literature relating to the Ainos, he would most certainly have avoided remarks upon this subject, and thus have saved himself from a predicament which, to say the least, looks extremely awkward.

As an answer to Prof. Morse, let him refer to the well-known *Russische Revue* (10 Heft, VI Yahrgang), edited by Carl Röttger. He will there find a quantity of valuable information relating to the Ainos, and amongst the rest something bearing on the point now under discussion, of which the following is a translation: "With reference to the anatomy (of the Ainos) it is remarkable that the humerus as well as the tibia has a very striking form; they are marked by an *extraordinary flattening (auserordentliche abplatung) such as has, up to the present, never been noticed of those bones in any people at present in existence.* On the other hand this peculiarity of form has been observed in the bones of extinct people found in caves." (The italics are mine.) Further remarks upon Prof. Morse's attack are, I think, unnecessary. If those who are interested in this subject will refer to my original article, it will be seen that much of what Prof. Morse has objected to, is due either to his misrepresentation of my language, or to his want of information on some of the subjects he has written upon; and I can assure your readers that the whole of his remarks may be answered as easily as the subject of platycnemic tibia has been answered.—*John Milne, Imperial College of Engineering, Tokio, Japan, Oct. 19, 1880.*

THE BOTANY OF CALIFORNIA, VOL. II, BY SERENO WATSON.—This beautiful volume is fully equal in beauty of finish, and botanical interest to its predecessor, which appeared in 1876.

The same externally, it internally presents the large clear type, and broad margins which distinguished the earlier volume. This volume begins with the Apetalæ, which includes twenty-five orders. Of these the Polygonaceæ and Chenopodiaceæ are particularly interesting on account of the numerous species of Eriogonum (52) and Chorizanthe (25) of the former, and of Atriplex (21) of the latter. The nineteen species of willows, are arranged and described by M. S. Bebb. Dr. Engelmann contributes the article on the oaks, of which there are fourteen species.

The Gymnosperms are placed, as is usual in English and American works, before the Monocotyledons. The Gnetaceæ are represented in California by two species of Ephedra, viz: *E. nevadensis* (a shrub two feet high) and *E. californica.* The Taxa-

ceæ are separated from the Coniferæ as a distinct order, including Torreya, with one species, *T. californica*, and Taxus, represented by *T. brevifolia*. The Coniferæ, proper, include eleven genera and thirty-four species. Of the latter, at least, sixteen exceed one hundred feet in height, and no less than eleven of these reach or exceed the height of two hundred feet. The Abietineæ are described by Dr. Engelmann, and the arrangement is consequently the most recent. Instead of the old genus Abies, as we all learned it in Gray's Manual, we have Abies, Pseudotsuga, Tsuga, and Picea. Under Pinus there are fourteen species.

In the Monocotyledons, the Orchidaceæ are not numerous. This is, however, not the case with the Liliaceæ, represented by thirty-one genera. Many of the genera are rich in species, *e. g.*, Allium with twenty-three; Brodiæa with fourteen; Lilium with eight; Fritillaria, eight; Calochortus, twenty-one. Three palms are described as occurring in the southern part of the State, viz: *Washingtonia filifera*, *Erythea edulis* and *E. armata*. The sedges and grasses, the latter by Dr. Thurber, occupy more than one hundred pages of the volume. Nearly one hundred more pages are filled with descriptions of the vascular Acrogens (by Prof. Eaton), and the cellular Acrogens (Musci and Sphagnaceæ only). Fifty pages of "additions and corrections," mostly to Vol. I, an excellent index, a glossary, and a "List of persons who have made botanical collections in California," by Prof. Brewer, complete this volume. The authors (Brewer, Watson and Gray, for Vol. I, and Watson, for Vol. II) are to be congratulated upon the successful completion of this great work, and the liberal-handed business men of the Golden State are to be commended for their public spirit in furnishing the means for its publication after the Legislature had refused to do so. No other State is now provided with so excellent a work upon its native plants.—*C. E. B.*

Balbiani's Lectures on the Generation of Vertebrates.[1]—This work corresponds in some degree to that of Kölliker on the development of man and the higher animals, but is confined rather to the earliest stages of development, and particularly to the mode of formation of the egg and the male reproductive elements, subjects now occupying very closely the attention of observers in the different countries of Europe, while unfortunately our own land does not contain in its population of 50,000,000, so far as we are aware, a single person who is studying the points regarding early vertebrate development in an original way. Should there be any one desirous of examining into the subject, he would find the volume before us, although a little *passé* in some points recently worked out by E. Van Beneden, McLeod, Balfour, and probably several biologists in Germany,

[1] *Leçons sur la Génération des Vertébrés.* Par G. Balbiani. Recueillies par le Dr. F. Henneguy, Revues par le Professeur. Avec 150 figures intercalées dans le texte et 6 planches en chromo-lithographie hors texte. Paris, O. Doin, 1879.

still as useful and certainly as readable an introduction as he could desire. Balbiani has contributed additions to our knowledge of reproduction in the Arthropods and in the Vertebrates, and considerable new matter, illustrated with six chromo-lithograph plates, is given in the present volume.

ZITTEL'S HAND-BOOK OF PALÆONTOLOGY.—We have previously noticed this valuable hand-book, which is being issued in parts, the present one being the fourth of Vol. I. This completes the first division of the present volume, which treats of fossil Protozoa, Cœlenterata, Echinodermata and Molluscoidea. The present part finishes the subject of fossil worms, but is mainly devoted to the Molluscoidea, namely the Bryozoa and Brachiopoda, which are placed under the Mollusca. It will thus be seen, that the classification so far from being modern, borders upon the paleozoic. Still the matter under each class heading is detailed, accurate; the fossils are interpreted by reference to the living forms, of which a concise description is given, and, as we have before said, this work of Zittel's, is on the whole, superior to any that the student can obtain.

MCALPINE'S BIOLOGICAL ATLAS.[1]—The title sufficiently describes this atlas, the plan of which is pretty good, though often the figures are clumsy, and more or less misleading. For example, the figures of the anatomy of the lobster are coarse, rough, and convey little idea of the parts as they exist in nature; they look as though they were copied from rough colored-chalk diagrams sketched off-hand on the blackboard. The "zoëa of the lobster" is a rough figure of some decapod zoëa, but not the young freshly hatched lobster, which, as the authors should have known, has a much more advanced form than here represented. The drawings of the nervous system and eye of the same animal are abominable. Indeed, we could scarcely recommend the book for use in our schools and colleges. Something much better could have been prepared for the same money.

EATON'S SYSTEMATIC FERN LIST.—Prof. Eaton, of Yale College, has recently issued a "Systematic Fern List," which will prove useful to our botanists, who wish to know what proportion of our native ferns they have in their collections. The list includes all the known ferns of the United States, and gives the geographical range of every species, and is intended "to serve as a check-list, and at the same time to show the classification of the genera." Of the one hundred and fifty-one species enumerated, one hundred and forty are true ferns (order Filices), the remaining eleven be-

[1] *Biological Atlas.* A guide to the practical study of plants and animals, adapted to the requirements of the London University, Sciences and Arts Department, and for use in schools and colleges, with accompanying text, containing arrangement and explanation, equivalent terms, glossary and classification. 423 colored figures and diagrams. By D. and A. N. MCALPINE. Edinburgh and London, W. and A. K. Johnston, 1880. 4to, pp. 49.

longing to the order Ophioglossaceæ. Of the true ferns, one hundred and twenty-nine species fall under the sub-order Polypodiaceæ, one under Ceratopterideæ, two under Hymenophyllaceæ, four under Schizæaceæ, and three under Osmundaceæ. The pamphlet, which contains twelve pages, and bears date of September, 1880, may be obtained for ten cents by addressing the author.—*C. E. B.*

THE ZOOLOGICAL RECORD FOR 1878.[1]—The fifteenth volume of this series is a little more bulky than the fourteenth, an evidence that the cultivators of the science of zoölogy are neither diminishing, nor the number of notices, articles and works contributed by them to journals and transactions. The editor and his assistants are the same as in the preceding volume, and we may feel sure that the omissions and errors inevitable to such work are comparatively few. It is a pity that so large a proportion, indeed almost the entire volume, is taken up with references to descriptions of new genera and species; these seem unfortunately to be as numerous as ever, and to draw away the attention of zoölogists, from the more pressing and legitimate objects of study.

The space devoted to biological and anatomical zoölogy should, it seems to us, be much greater than at present, and be made fully as prominent a topic as purely descriptive work; for this reason the parts on Cœlenterata and Echinodermata, Mollusca and Crustacea, with their analyses of discoveries made in the anatomy and physiology of these animals, is treated with more care and judgment than some other chapters. It seems to us that abstracts of articles in such journals as Siebold and Kölliker's Zeitschrift für wissenschaftliche Zoölogie, Troschel's Archiv für Naturgeschichte, and the similar French journals of Milne-Edwards and Lacaze Duthiers, as well as the *Quarterly Journal of Microscopical Science*, should be fuller, as these periodicals really contain the best material, *i. e.*, that which contributes most to the advancement of the science, and is or should be most eagerly read by students. As the new species get worked up, we may hope that more room will be found for such abstracts, as these are especially desirable for American students, who are exposed to the temptation of forsaking the true objects of zoölogical study, and betaking themselves to the mechanical, and not particularly intellectual work of describing new species and genera, and preparing local faunal lists without reference to future monographical work.

We may add what we have said in notices of previous volumes of this series, that no American student of systematic zoölogy can afford to be without the *Record*, particularly those living away from large libraries.

JOURDAN'S ZOANTHARIAN CORALS OF THE GULF OF MARSEILLES. This important and well illustrated memoir, which appears in

[1] *The Zoölogical Record for 1878;* being volume fifteenth of the Record of Zoölogical Literature. Edited by E. C. Rye, F. L. S., etc. London, 1880. 8vo.

the Annales des Sciences Naturelles for 1880, bears particularly on the histology and embryology of the sea-anemonies and the coral Balanophyllia, and should be studied in connection with the brothers Hertwig's nearly contemporaneous work on the histology of the Actiniæ, now brought to a close in the Jena Zeitschrift.

Bastian's The Brain as an Organ of Mind.[1]—One of the author's objects in the preparation of this book was to show that not the brain alone, but the entire nervous system, is the organ of the creature's "mind," and this is shown by reference to the lower animals as well as the vertebrates. He also attacks Ferrier's conclusions as to the localization of the different intellectual powers in the human brain, believing that our knowledge is too imperfect to decide that. But while these are salient points which give tone to the book, the author has presented us with a most useful work upon the nervous systems of animals in general and the correspondence between the structure of the brain of the different classes of vertebrates and their mental powers, which is both novel and useful.

After treating of the nervous system of mollusks, worms and arthropods (crustacea and insects), the author reviews the data derived from a study of the nervous system of invertebrates, and claims that in insects the sense of smell is "marvelously keen," while that of hearing is "developed to a very slight extent." Here we may say that Dr. Bastian has not apparently availed himself of the latest studies on the internal structure of the brain of crustacea and insects by Dietl, Flögel and Krieger, and his own countryman, Mr. E. T. Newton; nor do we think he treats with sufficient detail or comprehensiveness the intellectual powers of insects. He is evidently more at home in the comparative structure of the brain of vertebrates, and here his conclusions and general views appear to us to be well grounded and sound.

As regards the vertebrates, beginning with an account of the brain of fishes and of Amphibia, he goes on to that of the reptiles and birds, and with these as a standard of comparison, pauses to consider the scope of mind in general, of reflex action and unconscious cognition, sensation, ideation and perception, and then discusses consciousness in the lower animals, the nature and origin of instinct, and of nascent reason, emotion, imagination and volition. These subjects will be interesting to those biologists who may be engaged in studying the habits and psychology of animals.

Dr. Bastian regards the whole nervous system as the "organ" of mind, the brain being merely its principal component part. According to his view, instead of supposing that mind and consciousness (in its ordinary acceptation) are co-extensive, mind should include all unconscious nerve actions as well as those

[1] The Brain as an Organ of Mind. By H. Charlton Bastian. With 184 illustrations. New York, 1880. D. Appleton & Co. 12mo,, pp. 708.

which are attended by consciousness. These views differ in one or other respect, he claims, from those of Spencer, Lewes and Bain, and still more widely on the other hand from the generality of metaphysicians who habitually regard mind as an entity, and speak of the "mind" using the brain as its instrument.

While the Medusa and organisms only a little above them, such as mollusks and worms, act unconsciously, the intellectual processes being but a few degrees more complex than those which may take place in a sun-dew or other sensitive plant, the author brings forward reasons for the belief that as the nervous system increases in complexity from the lowest animals to the fishes, reptiles and birds, so the mental and motor phenomena of which such organisms are capable, show a similar tendency to increase in complexity. Consciousness first seems to appear, according to the author, in insects, Cephalopods, fishes, reptiles and birds. "These organisms are so high in the scale of organization as to leave no room for doubt that some of their nerve actions are attended by conscious states, but it is impossible for us definitely to decide which are and which are not so endowed."

He ascribes little reason to insects, believing that "while the instincts of birds are perhaps less elaborate, their adaptive intelligence or reason and the strength and definiteness of their emotions are unquestionably far superior to those presented by the social insects." Moreover, the author logically claims that reason, imagination and volition are "mere higher developments arising out of previous processes," such as the automatic actions of the lower animals.

Bastian then describes the brain of mammals, especially Quadrumana, and claims that there is a progression in mental capacity from the lower mammals to the monkeys and apes: "The development of intelligence, emotion and volition, which becomes so obvious in lower Quadrumana, is, however, recognizable in a still more striking degree when we come to the so-called man-like apes, viz., the gibbons, the chimpanzee, the gorilla, and the orang-outang."

The concluding half of the book is devoted to the human brain and human psychology. The chief interest of the book to us is the fact so well brought out that the leading features of the mind of man have their germs in the mental processes of the lower animals, and that there is, on the whole, a progressive development from invertebrates to man.

Finally the author states his belief that "every higher intellectual and moral process—just as much as every lower sensorial or perceptive process—involves the activity of certain related cell-and-fibre networks in the cerebral cortex, and is absolutely dependent upon the functional activity of such networks." He claims that "consciousness or feeling must be a phenomenon having a natural origin, or else it must be a non-natural, non-

material entity." On the other hand, he is decidedly opposed to the doctrine of automatism held by some extreme evolutionists, closing his book with these words: "But we certainly should not, on this account, allow ourselves to be mentally paralyzed by a belief in the existence of a metaphysical gulf between what is termed the subjective and the objective—the 'Ego' and the 'Non-Ego.' Yet, even some believers in the philosophy of evolution have thus been led to deny the natural origin of conscious states, and have, as a consequence, found themselves forced to hold a doctrine of thoroughgoing 'Automatism'—one in which all notions of free will, duty and moral obligation would seem, from this theoretical basis, to be alike consigned to a common grave, together with the underlying powers of self-education and self-control."

As to the moral nature, Bastian believes that it originated in savage life, after society developed, and says nothing as to the possible existence of the germs in the animals below man.

MASON'S MICROSCOPIC STUDIES ON THE CENTRAL NERVOUS SYSTEM OF REPTILES AND BATRACHIANS.[1]—The author here deals with the form of the spinal cord, and especially that of its enlargement; the nuclei of the nerve cells, and variations in their shape, size, etc., in the same individual: the number of ganglionic bodies in the spinal cord, and their relations to the roots of the spinal nerves, and the difference, if any, which may be determined by sex. After stating the methods of preparation of his sections, Dr. Mason, as a result of very extended examinations of a large number of what we can testify to be beautiful sections of the spinal cord of the frog and different reptiles, concludes as follows:

1. The central canal of the spinal cord of frogs is more nearly cylindrical in shape than has been generally supposed. The oval contour is not seen in cross sections below the second pair of nerves, when the membranes are not removed before hardening.

2. The nuclei of the large nerve-cells are more generally oval in form than are those of the smaller cells.

3. The nerve-cells of the crural enlargement are as abundant as those of the brachial enlargement, if not more so. Their nuclei are larger, as are also the surrounding masses of protoplasm or cell bodies.

4. No difference in structure can be made out in the upper portion of the cord, corresponding with the sexual function in the male. The long-continued and violent tonic spasms of the anterior extremities, must be explained by local hyperæmia influencing the same structure as those which exist in the female.

5. The relation which is generally believed to exist between the

[1] *Microscopic Studies on the Central Nervous System of Reptiles and Batrachians.* The spinal cord of the frog, *Rana pipiens, Rana halecina.* By JOHN J. MASON, M. D. (Reprinted from the Journal of Nervous and Mental Disease. Jan. 1880.) Chicago, 1880. 8vo, pp. 8.

so-called motor-cells and the inferior (anterior) roots, can be demonstrated in the frog more readily than in any other animal.

We shall look with much interest for future contributions by the author to our knowledge of the histology of the nervous system of the lower vertebrates, as it is a field greatly neglected in this country, Dr. Dean's monograph on the general subject not having been succeeded by similar works until the present time; these studies, moreover, have a great interest in connection with the views of Lewes and Bastian.

RECENT BOOKS AND PAMPHLETS.—The Geology of Hudson county, New Jersey. By Israel C. Russell. (From the Annals of the New York Academy of Sciences, Vol. II, No. 2.) From the author.

The Antiquity of Man and the Origin of Species. By J. W. Dawson. (From the Princeton Review.) From the author.

List of papers communicated to the American Philosophical Society. By Pliny Earle Chase, LL.D. From the author.

The Mica veins of North Carolina. By W. C. Kerr, State geologist North Carolina. (From Transactions of the American Institute Mining Engineers, 1880.)

Topography as affected by the rotation of the Earth. By W. C. Kerr, State geologist North Carolina. (From Proc. Amer. Philos. Soc., 1873.)

Notes on the Vertebrata of the Pre-glacial Forest Bed Series of the East of England. By E. T. Newton, F.G.S. (Ext. from the Geological Magazine, Decade II, Vol. VII, No. 9, p. 424. London, 1880.)

Revision of the Land Snails of Palæozoic Era, with descriptions of new species. By J. W. Dawson. (From the American Journal of Science, Vol. XX, November, 1880.)

Bulletin of U. S. Geol. and Geog. Surv. Terrs. F. V. Hayden, Vol. V, Nos. 3, and 4.

Classification of the Cryptogams. By Alfred W. Bennet. Reformed System of Terminology in Thallophyta. By Alfred W. Bennett and George Murray. (From the Quarterly Journal of Microscopical Science, 1880.) From the authors.

Nouvelles Recherches sur les Poissons Fossiles, découverts par M. Alby A. Licata en Sicile. Par M. H. E. Sauvage. From the author.

Sur un Reptile très perfectionné, trouvé dans le terrian permien. Par M. A. Gaudry. (From Comptes Rendus de l'Académie des Sciences, Oct., 1880.) From the author.

De la Nécessité D'Une Zoographie Apropos de la Phytographie de M. A. de Candolle. Par Dr. E. L. Trouessart. (Extrait du Journal le Naturaliste, No. 31, 1er Juillet, 1880.) From the author.

The Gold Gravels of North Carolina; their structure and origin. By W. C. Kerr, State geologist N. C. (From Transactions of the Amercian Institute of Mining Engineers.) From the author.

Report of the Committe Mutual Improvement Society of Queenwood College, 1880.

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## GENERAL NOTES.

### BOTANY.[1]

RELATION OF ELEVATION TO CHANGE OF COLOR IN FLOWERS.—Having seen many speculations on elevation as occasioning a change in the color of flowers, and *Gilia aggregata* having been mentioned as an example, I will state that I found, this summer, at the border of Idaho and Oregon, lat. 47°, on Coplen's butte, a hill of considerable elevation, large numbers of specimens growing near each other, varying from almost scarlet to a nearly clear white. They seemed equally vigorous, and were so intermingled that no difference of slope or elevation would account for the variation. Near Hood river, Oregon, at a much lower elevation, I found only specimens of a deep pink, approaching crimson.—*Jos. W. Marsh, Forest Grove, Oregon.*

INSECT-DESTROYING FUNGI.—Every one has doubtless often seen in the autumn and early winter, dead flies adhering to the ceiling and various objects in the room, and which, upon close inspection, are seen to be swollen, with the abdomen covered with a white powdery substance. Dissection of fresh specimens of such flies reveals a great number of short, colorless, branching nonseptate hyphæ, whose granular protoplasm contains numerous oil globules. These hyphæ are the vegetative organs of a parasitic plant to which the name *Empusa muscæ* is frequently given, and under this name it may be found briefly described in many books on fungi. It is now, however, pretty well established that we have here again another instance of a very common mistake in cryptogamic botany, that is, a description and classification based upon a knowledge of only one stage of the plant. Cohn ten years ago suspected this to be the case, but it remained for Brefeld and Nowakowski to demonstrate it, which they did in 1877. The latest contribution to our knowledge of the group of plants to which the fly fungus is now referred, is by Giard (Deux espèces d'Entomophthora nouvelles pour la Flora Française) in the Bulletin Scientifique du Département du Nord.

The results of these several investigations are that the old genera Empusa and Tarichium are now to be considered as respectively, the asexual and sexual stages of low forms of the order Saprolegniaceæ, and Giard proposes that the two old names be retained to designate the stages, and that the much more applicable name Entomophthora, proposed by Fresenius, be used to designate the genus. The fly fungus will accordingly be known as *Entomophthora muscæ* Fres.

The life-history of the Entomophthoræ may be briefly summarized as follows:

1, *Empusa stage.*—The short colorless branching hyphæ ramify through the tissues of the host, their swollen extremities eventu-

[1] Edited by PROF. C. E. BESSEY, Ames, Iowa.

ally coming to the exterior surface, where by constriction each gives rise to one or more spheroidal conidia. These conidia constitute the white powdery substance spoken of above. Conidia have been observed to germinate in water, sending out long thick hyphæ. Doubtless they serve in some way to quickly communicate the parasite from host to host, but the particular manner of their doing this has not yet been made out.

2. *Tarichium stage.*—In the same host which sustained the Empusa stage, or possibly in another, the hyphæ develop the sexual organs. These are similar to those found in other Saprolegniaceæ, and give rise to oöspores, which have thick and sometimes reticulated walls. The hyphæ and ripe oöspores occupy the cavity of the body of the host as a pulverulent mass. The oöspores (the hypnospores of Cohn) are disseminated by the decay of the body of the host, and after a period of rest reproduce the parasite again.

There are doubtless many species of Entomophthora in the United States, but so far as the writer is aware they have been but little studied.

Giard describes a species *(E. calliphoræ)* which is found in France parasitic upon *Musca (Calliphora) vomitoria;* and as this host is one of our common meat flies it is altogether likely that its enemy is to be found here also. The fungus long ago described by Leidy (although not named by him) as occurring in the abdomen of the seventeen-year Cicada, appears from his figures to be a species of this genus. Peck, in the Thirty-first Report of the N. Y. State Museum of Natural History, describes what is probably the Tarichium stage of the same parasite under the new genus Massospora, and says, "it apparently belongs to the Coniomycetes." The species he names *M. cicadina.* Probably the "muscardine" of the silk-worm (the so-called *Botrytis bassiana)* will be found to belong here also.

Bennett's Classification of the Cryptogams.—In the recent meeting of the British Association for the Advancement of Science, A. W. Bennett proposed a considerable modification of the classification given by Sachs in the fourth edition of the "Lehrbuch." The following sketch will convey to the student who is familiar with Sachs' work, a good idea of the proposed classification.

I. THALLOPHYTA.

Class I. Protophyta.

Sub-class Protomycetes.

Order *Schizomycetes.*

Under this order Saccharomyces is regarded as an aberrant form.

Sub-class Protophyceæ.

Orders, *Protococcaceæ, Nostocaceæ, Oscillatorieæ, Rivulariеæ.*

*Myxomycetes,* a low group supplementary to the Protophyta, not exhibiting true sexual conjugation.

CLASS II. FUNGI.

Sub-class Zygomycetes.

Order *Mucorini.*

Sub-class Oömycetes.

Orders *Peronosporeæ* and *Saprolegniaceæ.*

Sub-class Carpomycetes.

Orders, *Uredineæ, Ustilagineæ, Basidiomycetes* and *Ascomycetes* (the last including the Sub-order *Lichenes*).

CLASS III. ALGÆ.

Sub-class, Zygophyceæ.

Orders *Pandorineæ, Hydrodictyeæ, Confervaceæ, Ulotrichaceæ, Ulvaceæ, Botrydieæ,* and *Conjugatæ* (the last including the Sub-orders *Desmidieæ, Diatomaceæ, Zygnemaceæ* and *Mesocarpeæ*).

Sub-class Oöphyceæ.

Orders *Volvocineæ, Siphoneæ, Sphæropleaceæ, Œdogoniaceæ, Fucaceæ* and *Phæosporeæ.*

Sub-class Carpophyceæ.

Orders *Coleochæteæ* and *Florideæ.*

II. CHARACEÆ.

No change is proposed in this group other than separating it as one of the primary divisions of the vegetable kingdom.

III. MUSCINEÆ.

No change is proposed in this division.

IV. VASCULAR CRYPTOGAMS.

Isosporia.

Orders *Filices* (including *Ophioglossaceæ*) *Lycopodiaceæ* and *Equisetaceæ.*

Heterosporia.

Orders *Rhizocarpeæ* and *Selaginellaceæ.*

BOTANICAL NOTES.—Planchon reports the advent of the American grape mildew *(Peronospora viticola)* in the vineyards of France, and Pirotta reports its presence in the Italian vineyards in the Appennines.——Thomas Meehan has prepared a valuable paper on forests and forestry for the forthcoming Report of the State Board of Agriculture of Pennsylvania, the advance sheets of which have been received. After a careful personal examination of the forests of portions of Pennsylvania, Virginia, North Carolina and Tennessee, he concludes "that there is much more timber in the country than people generally believe, though at present in localities not convenient, as a general thing, to market at paying prices." He notes the great rapidity of growth in the trees of the region examined, as contrasted with their slow growth in Europe, and maintains that with proper care and culture, good paying timber can be grown in from fifteen to twenty years.——In the *Journal of Botany* for November, Henry Trimen has an interesting article "On the plant affording Ceará India rubber." It is a Brazilian tree *(Manihot glaziovii)* now grown in Ceylon, and it promises to become a valuable rubber-producing tree.——In the October *Bulletin* of the Torrey Botanical Club, Mr. Le Roy reports a remarkable case of duration of vitality of the seeds of an undetermined Cucurbit from Patagonia. Seeds from a specimen collected by the Wilkes Exploring Expedition between 1838

and 1842, were planted and successfully germinated the past summer.—In the same journal W. R. Gerard begins a "List of the State and local floras of the United States;" it gives the name, date and place of publication of all the important catalogues of plants ever published in this country. As such a list will be very useful to botanists, all who can should contribute to its completeness by communicating with the author, at 9 Waverly Place, New York city.——Botanists will be glad to learn that the publication of Dr. T. F. Allen's promising work, "Characeæ Americanæ" has been resumed. The parts now contain three plates each.——"A manual of the mosses of the United States" is said to be in course of preparation by Thos. P. James and Leo Lesquereux. The authors hope to publish it sometime during 1881.——Dr. Uhlworm's "Botanisches Centralblatt," which covers much the same ground as the well known "Botanischer Jahresbericht," by Dr. Just, promises to be more valuable than the latter in one respect at least, and that is in the greater promptness of its publication. Anderson, Farlow, Harvey, Lesquereux, Parry and Rothrock are the American contributors.——The papers in the last number of Pringsheim's *Jahrbücher für wissenschaftliche Botanik* are one by Bretfeld upon the healing of wounds, and the separation of the leaf from the twig; one by Müller upon the glands of the Cruciferæ; one by Tangl upon the open passages between the cells in the endosperm of certain seeds *(e. g., Strychnos nux-vomica, Areca oleracea* and *Phœnix dactylifera);* and one by Bachman upon the corky outgrowths upon leaves. ——The October number of the *Quarterly Journal of Microscopical Science* contains two botanical articles, viz: Bennett on the classification of Cryptogams, and Bennett and Murray on a reformed system of terminology of the reproductive organs of Cryptogamia. The latter will be more fully noticed hereafter. ——Thomas Meehan has been studying the question of the cause of the timber line upon high mountains (Proc. A. N. S. of Philadelphia, Sept., 1880). On Gray's peak the coniferous trees near the line of 11,000 feet are thirty to forty feet high, but at this line they cease as suddenly "as if a wood had been cut half away by a woodman's axe." Beyond the timber line the same species exist as dwarf, stunted trailing shrubs, often extending fifteen hundred feet higher up the mountain side. These stunted plants appear never to produce seed! Mr. Meehan's studies in the mountains of North Carolina and in the White mountains of New Hampshire, lead him to the conclusion that the stunted plants are the struggling offspring of trees which at no very remote period extended much further up the mountain than they do now. The reason for the disappearance of the large trees he believes to be due mostly to the disintegration of the rocks and the washing down of the earth from the higher elevations, thus starving the larger vegetation, while still affording conditions permitting the growth of smaller plants.

## ZOÖLOGY.[1]

NOTES ON THE LAND-SHELLS OF DOMINICA.—Mr. Guppy, in the *Annals and Magazine* for 1868, has some remarks on the shells of Dominica, which are partly reproduced by Bland (*Am. Jour. Conch.*, Vol. IV., 1868). My stay in Dominica was too short to allow of a complete investigation of the conchology of the island, but was long enough to enable me to ascertain that Guppy's notes, especially as to the distribution of the shells, are extremely erroneous. He says, "on the lower slopes near the sea I found a few Mollusca, chiefly *Bulimus exilis*, *Stenostoma octona*, *Succinea approximans* and *Helicina humilis*. Ascending higher, we find *H. denticus*, *H. badia*, *H. josephinæ*, *H. nigrescens*, *Amphibulina patula*, *B. laticinctus* and *Heligina epistilia*. Excepting the last, all these species are found everywhere above 300 or 400 feet of elevation." The fact is that while the first-named species are found on the lower slopes, they are not all which are so found. *H. badia* and *H. denticus* are found abundantly in the gardens in Roseau, but disappear or occur but very sparingly above 800 feet, their place being taken by *H. nigrescens* and *H. josephinæ*, which I have never detected below 800 feet. My notes are necessarily imperfect, but through the kindness of my friend, Dr. H. A. Alford Nicholls, of Roseau, who is making observations and collecting for me, and by more extended collections which I hope to make in person this winter, I shall be able to add to them.

I append a list of the species, not as a complete list of the shells of Dominica, but only of those which I have myself collected.

*Helix baudoni* Petit.—So closely allied to *H. concolor* Fer., that I doubt its claim to specific rank. Not common. Road from Roseau to Rosalie; 2000 feet. I have not detected it on the lower slopes.

*Helix badia* Ferussac.—Abundant on the lower slopes down to sea level, but occurs very sparingly above 800 feet. All the specimens I have seen are smaller than those from Guadeloupe or Martinique.

*Helix josephinæ* Ferussac.—Quite abundant above 1000 feet. Last whorl more rounded than in the Guadeloupe specimens.

*Helix denticus* Ferussac.—Common on the lower slopes down to sea level; rare above 800 feet.

*Helix nigrescens* Wood.—Abundant above 1000 feet.

*Bulimus virginalis* Pfeiffer.—On trees 2000 feet; not common.

*Bulimus multifasciatus* Lamarck.—On trees 2000 feet; not common.

*Bulimus exilis* Gmelin.—Abundant below 1000 feet; occurs more sparingly above this height.

[1] The departments of Ornithology and Mammalogy are conducted by Dr. ELLIOTT COUES, U. S. A., Washington, D. C.

*Bulimus nichollsii* Nob.—Quite common on road from Roseau to Rosalie; 2000 feet.

*Stenogyra octona* Chemnitz.—Abundant everywhere.

*Tornatellina antillarum* Shuttleworth.—Sparingly at about 500 feet.

*Succinia approximans* Shuttleworth.—Not common; 300 feet.

*Succinia rubescens* Deshayes.—Not common; 300 feet.

*Amphibulina patula* Bruguiere.—Not common; on bananas at Laudat; 2000 feet. Shell rather larger and more corrugated than the St. Kitts specimens.

*Amphibulina tigrina* Lesseur.—Rare, 1000 feet on bananas. I have not seen *A. pardilina* Guppy, but fancy it may prove this.

*Cyclophorus schrammi* Shuttleworth (?).—Quite common at 1500 feet. I can see no difference between this and specimens of *C. schrammi* from Guadeloupe. *Cyclotus amethystinus* Guppy, I have not seen, but from his own description it is evident that his shell is not a Cyclotus but a Cyclophorus, and presumably this species.

*Helicina platycheila* Muhlfeldt. Not common; 800 feet.

*Helicina rhodostoma* Gray. Not common; 1500 feet.

*Helicina fasciata* Lamarck.—Not rare; 800 feet.

*Helicina antillarum* Sowerby. Common everywhere, but most abundant in the lower slopes.

Bland (Ann. Lyceum, Vol. x, 1872) quotes a letter from Dr. W. J. Branch, of St. Kitts, to the effect that *Amphibulina patula* is unable to contract the entire animal within the shell, but expresses his doubt as to the truth of this observation. I have frequently seen the animal completely contracted within the shell in living specimens, although it is not its usual habit even when alarmed; if thrown into alcohol or glycerine, it immediately withdraws the whole body into the shell.

In giving the altitude at which the different species occur, I mean, that so far neither Dr. Nicholls nor myself have found them at any less elevation. Further search in which Dr. Nicholls is now engaged will undoubtedly extend their range, but I am quite confident that none of the species will be found to vary materially from these figures in their distribution as to elevation.—*A. D. Brown.*

Breeding Habits of the European as Compared with those of the American Oyster.—Regarding this interesting subject, we print the following extract from a letter from Capt. Francis Winslow, U. S. N., to Prof. W. K. Brooks, of Johns Hopkins University.

"U. S. S. Saratoga, Gibraltar, June 14, 1880.

"I got hold of some oysters in Cadiz a few days ago, and upon examining them found them in so favorable a condition that I attempted to fertilize the eggs according to your method, and I thought you might like to know that the experiment has been

completely successful. The young are now eight days old, and are thriving wonderfully. I labor under a great many inconveniences, and against many obstacles, having only a couple of fruit jars to hold the animals, and a very poor little microscope, but it is sufficiently powerful to enable one to trace the course of development in a general way, and that I have done.

"Of course I have a good many other duties, and since our arrival here I have been trying to find out some things about the sub-current in the Straits, consequently I could not give the oysters all the attention I desired, but I have followed them through each step as nearly as possible, and they have been exactly as you have figured for the American animal. I have seen them assume the form of each figure or set of figures[1] successively, and they are now about as your last figures show them. I shall watch them as closely as possible henceforward, though the necessity for transferring them to a larger vessel, may prevent my continuing the observations, and as we sail to-morrow, a gale of wind may send my young brood afloat again in the briny ocean. I think my success is due to the uniform temperature of my room where I have kept the jars. Though I have not registered it, yet it must be nearly the same at all times, for I am personally aware that the atmosphere is rarely changed in any way. The brood is the offspring of two males and two females, and the whole lot which I examined appeared exactly as did those we are familiar with. The adults came from the waters of Cadiz bay, and are natives.

"So far as these results go, they prove that the artificial propagation of the European oyster is practicable to just the same extent as our own, and I think that it throws grave doubts upon the theory that the embryo is protected within the shell, and that the impregnation of the ova occurs there and nowhere else.

"I am quite elated over my success, and thought that probably it would interest you, and therefore have written. I have made but one deviation from your method, and that was in the supplying of water. I have given but very little new water, rarely a gill and a half a day. I am very truly yours, FRANCIS WINSLOW."

CHANGE IN THE NERVOUS SYSTEM OF BEETLES DURING METAMORPHOSIS.—This subject has been studied with great thoroughness of detail in text and illustration by H. Michels. (See the Zeitschrift für wissenschaftliche Zoologie for September 10, 1880) The figures are the most important ever given, supplementing and greatly extending Newport's celebrated figures of the changes in the sphinx from the caterpillar to the moth, as well as Weismann's researches on the flesh fly. Michels concludes that the separate ganglia of the ventral cord of the pupa and imago are formed during metamorphosis from the larval stage, not *de novo*,

[1] See Prof. W. K. Brook's, the Development of the Oyster. Studies from the Biological Laboratory of Johns Hopkins University.—*Eds.*

but that the different ganglia persist from the larval state. The peripheral nerves also persist or survive from the larva to the beetle (the species studied was *Oryctes nasicornis);* besides there is an increase in the number, or accession of new nerves different from those in the larva, and peculiar to the beetle.

A *punktsubstance*, in Leydig's sense, appears to be wanting, as also the transverse commissures usually uniting the hemispheres of a ganglion. In place of the latter are extraordinarily numerous transverse bundles of fibers which, arising from the ganglion cells of one side, form the peripheral nerves of the other side, and also a bundle which passing through the interlacing of each half of the ventral cord, assumes three longitudinal directions. These nerve-fibers running parallel to the axis pass continuously from one end of the ventral cord to the other, forming in fact the longitudinal commissures of the ventral cord. These commissures take their origin neither out of a central punktsubstance, nor from a peripheral ganglion mass, but are mere continuations of longitudinal nerve-fibers decreasing posteriorly in thickness, and which extend through the œsophageal ring commissures to the brain.

A New Genus of Catostomidæ.—Prof. D. S. Jordan, informs me that the dentition of his genus *Chasmistes* is identical with that of *Catostomus*. The two species from Klamath lake, Oregon, described by me under the names of *Chasmistes luxatus* and *C. brevirostris* (American Naturalist, 1879, 785), exhibit a different type of dentition. The pharyngeal bones are very slender and are flattened, and their teeth are minute and very numerous, as in *Carpiodes*. The genus thus defined will stand in the *Catostomine* division, and next the *Bubalichthyinæ*, and may be called Lipomyzon.—*E. D. Cope.*

Cellular Irritability.—M. Richet in the *Revue Scientifique*, gives the following synopsis of the effects of stimuli on simple animal and vegetable cells. (1) Oxygen is necessary, and there is consumption of oxygen during the life of the cellule. (2) The intensity of movements grows with the temperature, up to 40° C.; above 40° the movements disappear. (3) Neutral solutions slightly alkaline are favorable; acid solutions are fatal. (4) All change of condition is a stimulant to the cell, and consequently provokes its contraction. (5) But this change of condition must be abrupt, for, if gradual, it does not provoke reaction. (6) The reaction from the stimulus is not sudden, but there is a period of "latent excitement" which diminishes in proportion to the intensity of the excitation. (7) Weak stimulation, powerless when isolated, becomes effective when frequently repeated at short intervals.

Budding in Free Medusæ.—The germination of the young from the walls of the proboscis of *Lizzia octopunctata* Forbes, seems to me to throw some light on a theoretical question of

"alternation of generation" in Willia, raised by Dr. Brooks in the September number of the NATURALIST. *Lizzia octopunctata* produces young by budding from the time she is herself attached to the parent until she acquires the form as figured by Forbes. After that time reproduction by gemmation, in the restricted sense of the word, ceases, and a sexual method takes its place. I have studied one of these Lizziæ in which the eggs had begun to form while yet buds were attached to the proboscis of the same. Can we not, therefore, instead of considering that there are two separate forms of Willia, one of which forms a new generation asexually, and another which reproduces by the egg, suppose, as is the case in Lizzia, that in the same individual, after the asexual method ceases, we have as final products of the somewhat similar process, the formation of eggs which, after contact with the sperm, pass through a sexual development?

If there are two forms of *Willia ornata*, they may be simply male and female. Was the "second form" of Willia, spoken of by Dr. Brooks, male or female? Before its sex is known, the theory of "alternation of generations," which he advances, is premature, and when it has been shown that the "second form" is a female, it remains to be demonstrated that the asexual "first form" does not ultimately develop into the second which lays eggs.—*J. Walter Fewkes, Cambridge, Dec. 6, 1880.*

ZOOLOGICAL NOTES.—Prof. Ercolani has recently studied the placenta of cartilaginous fishes, and of mammals, with reference to classification and anthropogeny. Another Italian, Prof. Ciaccio has communicated to the Academy of Sciences of Bologna the results of his examination of the intimate structure of the eyes of Diptera, and also those of a blind Talpa.——Mr. Swinton's book on "insect variety" is not favorably reviewed by *Nature;* though it is said to be full of original observations. It is devoted mainly to the subjects of mimicry, odors, dances, colors, music, and insect variation.——A writer in *Nature* confirms Mr. Ober's statement in his "Camps in the Caribbees," as to the singular habit of the gnat beetle, *Dynastes hercules*, which seizes hold of a branch of a tree, and whirls around by its wings until the limb is severed. Mr. Ernst, of Caraccas, says the beetle wants to get at the abundant juice of the young branches. He adds that the *Golofa porteri*, an allied insect of the same family, behaves in a similar way, but chooses of course thinner branches.——The *Zoologischer Anzeiger* for November 1, contains the conclusion of Studer's notice of sexual dimorphism in Echinoderms.——The structure of the poison apparatus of spiders has recently been studied by J. MacLeod of Belgium.——About 7800 species of Heteropterous Hemiptera had been described up to the year 1879, while up to 1859 about 3000 species of Homopterous Hemiptera had been catalogued. Mr. Uhler has estimated that there are probably not less than 10,000 species of North American Hemiptera.

## ENTOMOLOGY.[1]

[SALUTATORY.—Having decided to discontinue the publication of the AMERICAN ENTOMOLOGIST, we hope to transfer the interest it represents to the pages of the NATURALIST, and bespeak for it the support of the subscribers and contributors to the first-named magazine. We shall not lose sight of the economic bearings of entomology, and hope to make the NATURALIST a welcome visitor not only to the student of insects, but to him or her whose principal anxiety is to protect from the injuries of these tiny marauders whether flower, fruit, cereal, shade tree or other product. As in the columns of the *American Entomologist*, we shall here consider and answer such questions as are of public interest, and we invite correspondence alike from the practical man, the amateur and the specialist. Separate copies of contributed articles will be furnished when required. We will also send the complete volume of the *American Entomologist*, just brought to a close, to any one desiring it, upon receipt of the club subscription rate, $1.50.—*C. V. R.*]

BIOLOGICAL NOTE ON EUPLECTRUS COMSTOCKII Howard.—During my stay in Selma, Ala., engaged in work for the U. S. Entomological Commission, from the end of August till October 12th of this year, I had ample opportunity to observe the above named interesting parasite of the cotton worm, and the following notes on its life history may, perhaps, prove not without interest, though they contain nothing new beyond Fonscolombe's observations on this and allied genera of Chalcididæ.

Though I often saw the perfect parasite on the leaves of the cotton plant, I never was fortunate enough to observe the act of egg-laying, and am, therefore, unable to state the length of time necessary for the egg to hatch. All the eggs which came under my observation always hatched either the same or the next day. Judging, however, from the rapid development of the insect under consideration, it is more than probable that the time elapsing from the laying of the egg to the issuing of the parasitic larva, does not much exceed two days. The egg is elongate-oval, strongly convex above and somewhat flattened beneath; no sculpture is visible under an ordinary lens. Its color is uniformly brown, and almost black just before hatching. The number of eggs laid by the female Euplectrus on a single Aletia larva, I found to vary from one to fifteen, the most common numbers being three, five and seven. They are always laid in a group, but the individual eggs sufficiently separate from each other to allow room for the development of the larvæ. In one instance I found two separate egg-groups on an Aletia larva, and these were, in all probability, laid by two females of Euplectrus. When only one or two eggs are found upon a worm, the presumption is that the

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., may be sent.

latter has been able to remove one or more of them, or that they dropped off from one cause or another. Eggs that have failed to hatch but that adhere to the worms are sometimes met with.

The Aletia larvæ attacked by this parasite are usually less than one-third grown, but not less than one day old. Exceptionally they are rather more than one-third grown. The eggs of the Euplectrus are usually laid on the middle of the back of the worm, sometimes a little more in front or behind or more towards the sides, and in one instance I saw them fastened immediately above one of the middle pair of thoracic legs.

The delicate egg-shell splits longitudinally in the middle of the back and discloses the white larva of the parasite, which gradually works the egg shell more and more down the sides of its body where, for some hours, it remains visible as a black line, but within less than twelve hours it disappears from view beneath the rapidly growing parasite larva. This last, as soon as it has freed its head from the egg shell, pierces the skin of its victim and thereafter remains stationary with its head buried. As soon as it has fairly begun to feed, the white color changes to a bright bluish-green, and the segments and spiracles which in the newly hatched larva were barely visible under high magnifying power, are now readily seen. The growth of the larva is very rapid, but seems to vary according to the season, averaging three days in August and four days in September. When full-grown the larvæ crowd each other, and if there are five or more of them on a caterpillar, they form a semi-globular lump of very striking appearance. Usually their growth is uniform, and retardation in development of individuals in the group results in death. When full-grown they turn yellowish-white and relax their hold.

The worm which up to this time showed no signs of being affected, except by its sickly yellowish color, and by its very slow growth, collapses and dies as soon as a single one of the parasitic larvæ withdraws, and the same fate overtakes those Euplectrus larvæ which are at the time less advanced in their development, or immature. If one of the parasitic larvæ be removed by hand, both the victimized worm and the remaining parasites quickly dry up.

The presumption that the Euplectrus larvæ may migrate from one worm to another is unfounded, they always remain stationary on the worm, which the parent fly has chosen as its victim, and they never ever move from the spot where the egg has been laid until they are full grown. Every attempt I made to transplant a larva from one worm to another invariably resulted in the death of the parasite.

In preparing for pupation, the larvæ manage by a peculiar elongation and sudden contraction of their abdominal joints to work from the back of the worm to the ventral or attached side where they spin fine silken threads, which more fully secure the

worm, which is now a mere empty skin, to the leaf. As the Euplectrus larvæ take their places side by side, the caterpillar skin is fastened its whole length to the leaf if there are five or more of the parasites, but if there are fewer only one portion of the skin, usually the anterior end is fastened, the remaining portion either hanging down or breaking off. This web of the Euplectrus larvæ consists of an irregular mesh of yellowish-white silk, recalling some kinds of mold, and spun to secure the caterpillar skin to the leaf, in addition to a few other threads to prevent the pupa from being moved from its place. This web should not properly be called a cocoon, its character is excellently expressed in Fonscolombe's words as quoted by Westwood[1]: "larva * * * ad metamorphosin filis aliquot sericis longiusculis crispis inordinatis involvitur."

Protected by the caterpillar skin as by a roof, the Euplectrus larva changes to the pupa, the color of which is dark honey-yellow, with the head and abdomen very soon becoming pitchy black. The duration of the pupa state varies from three to eight days.

The Euplectrus is subject to the attacks of a secondary parasite of its own family, and its pupa is sometimes destroyed by another enemy, probably some Carabid beetle.

Cotton worms infested with the Euplectrus were by no means rare during the month of September, and the almost complete destruction of the worms in the earlier part of October was principally due to this parasite, and to a species of Microgaster hitherto unmentioned as a parasite on Aletia.—*E. A. Schwarz, Washington, D. C.*

Oviposition in the Tortricidæ.—The remarks on this subject by the editor, in the November number of the *American Entomologist*, suggest that the observations I have made on the life history of *Tortrix fumiferana* Clem., may possibly be of interest.

I have been endeavoring for several years to carry this insect through all its stages, but have not yet been able to complete all the links in the chain. It was originally described by Clemens in 1865, under the above name, but doubtfully referred to the genus Tortrix, the type being the more common form of this variable species. Robinson seems to have overlooked this insect among the types of Clemens and re-described one of the reddish-brown varieties under the name of *Tortrix nigridea.*

Some three years ago I was informed that "worms in prodigious numbers were utterly destroying the evergreen forests" in some parts of this State, and a box of them, enclosed with some of the twigs, was sent to me, but was not received until after they had emerged and crawled over and among the twigs till they were denuded past recognition.

[1] Introd. II, p. 163.

The next year, however, I was able to get them sent to me in the larva and pupa states and had them emerge in confinement. Many, however, proved to be parasited and a large number of specimens of *Pimpla conquisitor* Say, together with several dipterous parasites and a hair-snake emerged from them. I could not convince myself that there was any difference in the activity of the larvæ, although nearly half of them finally proved to have contained parasites of large size.

The pupæ were kept in a glass observing cage, and soon after their emergence the sexes began to pair, quite irrespective of the time of day, some early in the morning, others in the middle of the day, and still others in the evening. It must be remembered that all my observations were made upon them in confinement, and that in nature, under different conditions, the ways of these insects *may* be somewhat different.

Having now a considerable number of impregnated females, they were disposed of so as to oviposit under different conditions. For one, a branch of fir (*Abies balsamea*) was supplied, this being their favorite food plant; others were put in dark boxes, while others were kept under glass beakers with no food plant.

The one provided with the branch of fir laid her eggs July 5th, about the middle of the forenoon. The manner of ovipositing was as follows: crawling upon the upper side of a leaf with her head towards the stem, she bent her abdomen down, depositing an egg a little to one side near the tip, then bending the abdomen a little to the other side she deposited another slightly overlapping the one already laid, then moving forward a bit and turning the abdomen to the other side another was laid, and so on till two continuous rows were laid upon the upper side, continuing to the base of the leaf, the eggs of the same row overlapping each other so much that not more than one-third of the upper side was free, while those of one row overlapped those of the other row by about a fourth of their width. After having finished the rows on one leaf, she went to another and continued as before, till one hundred and twenty-five were deposited.

The time required for the deposition of an egg was not far from five seconds, and the female continued her work almost without interruption till all those on one leaf were deposited; then an interval of a few minutes elapsed before she began on another.

The eggs are flattened, slightly elliptical, $1\frac{2}{5}$ mm. long and 1 mm. wide, of a bright green color, surface smooth under an ordinary lens.

I carefully watched another female with a lens, while ovipositing on the inside of a thin glass beaker. The abdomen was raised after the deposit of the egg and bent a little to one side, as described above, for the purpose of depositing a second egg; only in this case the eggs were not confined to two rows, but varied in number till as many as six or more rows were laid, forming an

irregular patch, apparently without order, sometimes entirely overlying each other so that it was impossible to make an exact count, but the mass contained not far from the same number as in the other case.

The opening to the ovipositor, immediately after the expulsion of an egg, opened and closed several times, the external side parts moving laterally, after which the abdomen was bent down, the opening distended and an egg excluded. There was no movement of the parts to arrange or place the egg, nor was there any further manipulation of the egg, on the part of the female, but at once the abdomen was raised, the usual movements of the opening and closing the orifice took place, when the apex was again bent down and another egg laid.

The eggs laid on the 5th of July began to show a dark spot near the free end about the 10th, which grew more and more visible till the 13th, when with the lens the dark spot showed itself to be the head of the embryo, and the green contents within could be resolved into the outline of the body doubled up. On the 15th of July, the young emerged, and a more restless lot of larvæ I do not remember to have seen.

These young do not eat the shells of the eggs as some larvæ do, but travel away from them as though their lives depended upon it. Finally some of them settled down in the axils of the leaves, spinning a few silken threads over and between the leaf and the stem. For a week they were quiet and I could not perceive that they had eaten anything since hatching. They had even lost the green color of the body and were now dull ochre yellow, except the head and thoracic plates, which were, as before, pitchy black.

At this time I transferred them to a living fir tree, but all died within a day or two, possibly because of the rough handling necessary to dislodge them.

If we may be permitted to *conjecture* the rest of their life history, they possibly spin themselves up in a cocoon in the axils of the leaf, where they remain during the fall and winter, coming out in the spring to feed up and pass through their later transformations.

The full-grown larva is 20 mm. in length, somewhat fusiform. Head of the ordinary form, jet black, as are also the middle joints of the antennæ, the legs and thoracic plate. The remaining joints of the antennæ, palpi, integument between the joints of the legs, mouth parts, front edge of the thoracic plate, and a narrow longitudinal line dividing the plate in two halves, dull light green. General color of the body above, dark brown, inclining to greenish-yellow between the segments. Tubercles, anal plate and prolegs, straw-yellow. A lateral yellowish stripe extends from the head to the last segment, having the stigmata in the center and enclosing on the lower side, the lateral folds of the segments, and in its upper edge, the second row of tubercles from the dorsum.

The anal plate is somewhat roughened and sparsely clothed

with stiff, yellowish hairs. Tubercles also surmounted by yellowish hairs. Underside dull greenish-brown, darker brown on the segments under the lateral fold.—*Prof. C. H. Fernald, State College, Orono, Maine.*

Supplementary Note on the Food of the Blue-bird.—When my paper on the food of the blue-bird was prepared for the September and October numbers of the *Entomologist*, I had no material illustrating the food of the species for the months between July and December, except two stomachs taken in September, the contents of which were so far exceptional that I excluded them from the table of the food. Since the publication of that paper I have studied the food of the blue-bird in August and September, and find the record for those months so different from that of the months preceding that an exact idea of the economical relations of the species cannot be given without taking it into account.

Twelve specimens were obtained in August at Normal, Ill.—three early in the month and the others on the 29th and 30th. The blue-birds were at this time most abundant in meadows and pastures, and the contents of their stomachs indicate that the chief business of the month was the pursuit of locusts, crickets and grasshoppers, moths and caterpillars.

The Orthoptera eaten by these birds amounted to fifty-eight per cent. of their food, and the Lepidoptera to twenty-seven per cent. About half of the former were Gryllidæ (Gryllus and Nemobius), and the remaining half were equally Locustidæ and Acrididæ (*Xiphidium fasciatum* and *ensifer*, *Caloptenus femur-rubrum* and *bivittatus* and *Œdipoda sordida*).

Half of the Lepidoptera were unrecognizable moths, and the remainder caterpillars, five per cent. being Noctuidæ. Ants were about one per cent. of the food, Coleoptera only five per cent. (including three per cent. Harpalidæ), Cydnidæ (*Cœnus delia*) one per cent., and spiders six per cent. A few wild cherries and elder berries were the only fruits taken. The beneficial elements thus amount to about nine or ten per cent. of the food, and the injurious elements to about eighty-five per cent.

All but one of the ten specimens upon which the account of the September food is based, were shot at Normal, and all but two on the twenty-ninth of the month. The chief peculiarity of the month is the almost total disappearance of Coleoptera, which were represented only by a few small Harpalids and a single minute Atænius. The Lepidotera rise to thirty-seven per cent. chiefly through the abundance of the larva of *Prodenia lineatella* Harvey. The Orthoptera make just half the food, the species differing from those of the preceding month mainly in the greater number of red-legged locusts. Spiders were only two per cent. of the food, and some unknown wild fruits formed seven per cent.

It will be seen that a striking change in the food of this species attends the increase of the Orthoptera in numbers and activity,

which occurs in the late summer and early autumnal months, these insects being almost entirely substituted for Coleoptera, Hemiptera and Arachnida. The Coleoptera of the six preceding months averaged twenty-seven per cent. of the food, while this order amounts to but three per cent. in August and September. The Orthoptera of the foregoing months averaged but fourteen per cent., while those of the two months in question rise to fifty-four per cent. As a consequence of this seasonal change, the most important general averages for the year given in the table on page 234 of the October *Entomologist*, should be amended as follows:

The Coleoptera drop from twenty-five per cent. to twenty, the Harpalidæ lose one per cent, and the Scarabæidæ two per cent.; Hemiptera, Arachnida and Myriapoda each also drop one per cent.; Orthoptera rise from twelve per cent. to twenty-one, and Lepidoptera from twenty-four per cent. to twenty-six. The grand total of injurious elements stands, as amended, at fifty-one per cent., and of beneficial elements at twenty-three. It is evident from the foregoing, that Orthoptera and smooth caterpillars are the favorite food of this bird, and as the first of these remain abundant until frost, it is not likely that the food of October is much less favorable to the bird than that of September. The two specimens taken in the former month were well filled with winged ants.—*Prof. S. A. Forbes, Normal, Ill.*

[Prof. Forbes is carrying on a most important work in his systematic studies on the food habits of birds. He is really making the first serious and accurate study of the subject attempted in this country, and the results in the end cannot fail to set at rest many of the questions constantly raised by the ornithophiles on the one hand and the fruit and grain growers on the other. The question is one that interests alike the entomologist, the ornithologist and the husbandman. It will be well to remark that in the October number of the *Entomologist* alluded to in the above communication, which is supplementary thereto, the totals in his table summarizing the observations made, were as follows:

SUMMARY OF THE FOOD OF THE BLUE-BIRD.

| | | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Total. | Ratio of each element to whole of Food. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. of Specimens Examined. | | | 10 | 21 | 13 | 9 | 10 | 9 | | 2 | | | 12 | 86 | |
| KINDS OF FOOD. | | Number of specimens and Ratios in which each Element of Food was found. | | | | | | | | | | | | | |
| Percentages for Each Month. | Beneficial Elements. . | | .46 | .28 | .21 | .35 | .38* | .14 | | | | | .11 | .28 | Totals for the Species. |
| | Injurious " . | | .41 | .60 | .23 | .55 | .26 | .67 | | | | | .02 | .39 | |
| | Neutral " . | | .13 | 12 | .56 | .10 | .34 | .19 | | | | | .87 | .33 | |

* Includes 8 per cent. fruit.

## ANTHROPOLOGY.[1]

MATÉRIAUX POUR L'HISTOIRE DE L'HOMME.—We are in receipt of *Livraisons*, three, four and five of this eminent periodical, and would call attention to the following articles: M. Gaudry has just published at Paris "Matériaux pour l'Histoire des temps quaternaires: second fascicule, F. Savy, 1880, p. 63 à 82. Pl. XII à XV." A short review of this work will be found in Matériaux, pp. 112–118, in which especial attention is invited to the occurrence of *Saiga tartarica* in the remains of the reindeer period. On page 127, is an abstract of a paper by H. Fischer in *Archiv für Anthropologie* upon the so-called Amazon stones and upon that fabled people. The author dwells especially upon the researches of M. Barbosa Rodrigues upon the tributaries of the Amazon, embodied in a work entitled, "Antiquités des Amazones, armes et instruments en pierre. A stone charm perforated longitudinally, called *muirakitan*, is spoken of as having great potency, resembles closely a series from Porto Rico, described by the editor of these notes in the Smithsonian Report, 1876, p. 378. fig. 30.

On page 201 is reproduced a paper prepared by J. J. da Silva Amada, professor in the school of medicine of Lisbon, upon the ethnogeny of Portugal. This publication was very timely, as it placed the readers of the *Révue d'Anthropologie* and of *Matériaux* in possession of sufficient knowledge concerning the general history of Portugal to listen intelligently to the papers before the International Congress of Anthropology and Prehistoric Archæology held this year in Lisbon.

A brief sketch of German anthropology begins on p. 220, but the only part of any importance is a very interesting account of the Kanikars, by M. Jagor. These people are a diminutive negroid race in Southern India, having crispy hair and living in huts among the trees, when they are in danger from tigers, wild boars, or elephants.

M. Piette proposes, p. 233, a new nomenclature, for archiethnologic races. Primarily we have the division into agrentic (hunters) and georgic (tillers of the soil.) The former is again divided into the barylithic and the leptolithic; the latter into the neolithic, the calcentic, and the protosideric. The editor of *Matériaux* wisely remarks that the public will decide whether any of these terms are happily chosen.

ANTHROPOLOGY IN AUSTRIA.—The *Mittheilungen der Anthropologischen Gesellschaft in Wien*, Band x, Nr. 1–7, contains the following papers: Bericht über die Versammlung osterreichischer Anthropologen und Urgeschichtsforscher am 28 und 29 Juli, 1879, zu Laibach, by Dr. M. Much; Weitere methodische Studien zur Kranio-und Kephalometrie, by Prof. Moriz Benedikt; Die Sage von Orpheus, Orfen des Rhodope-Bulgaren, by Prof. Geitler; Die

[1]Edited by Prof. OTIS T. MASON, Columbian College, Washington, D. C.

Juda in den Mythen der Balkanvölker, by Prof. Geitler; Neuere ethnologische Entdeckunken auf der Balkanhalbinsel, by Dr. Fligier.

ANTHROPOLOGY IN ITALY.—In the second fasciculus of the tenth volume of "Archivio per l'Antropologia e la Etnologia," we have the following original papers: Studii Antropologici sui Lapponi, by Paolo Mantegazza and Stephen Sommier; Materiali per l'Etnologia Italiana, Riassunti e commentali, by Dr. E. Raseri; Appunti sulla Etnologia del Madagascar, by Prof. Arturo Zannetti; Il Processo Paroccipitale e la Pars Mastoidea del temporale dei Mammiferi nell'Uomo, by Dr. Guiseppe Amadei. The first named paper is illustrated with ten very finely executed photographic plates.

ARCHIV FÜR ANTHROPOLOGIE.—The twelfth volume of this notable Journal closes with the number for August, 1880. The leading communications bear the following titles: Ueber die Berechnung des Schädelindex aus Messungen an lebenden Menschen, by Dr. Ludwig Stieda; Die Metallarbeiten von Mykenä und ihre Bedeutung für die allgemeine Geschichte der Metallindustrie, by Christian Hostmann, in Celle; Zur Hohenmessung des Schädels, by Dr. J. Geldmeister; Bemerkungen über die Squama ossis occipitis mit besonderer Berücksichtigung des "Torus occipitalis," by W. Waldeyer, Table IX, Figs. 1, 2; Der Trochanter tertius des Menschen nebst Bemerkungen zur Anatomie des Os femoris, by W. Waldeyer; Ueber Timur's (Tamerlans) Nabstein aus Nephrit, by H. Fischer. Under the subject of reviews, we have some most valuable contributions to anthropological literature, to wit: Berichte aus der russischer Literatur über Anthropologie, Ethnographie, und Archäologie für das Jahr 1878, by Dr. Ludwig Stieda, of Dorpat. This is a continuation and the close of a communication from page 382 of the Archiv. It is exceedingly valuable, containing thirty-eight pages of closely printed matter, embracing titles of works in full with brief summaries of their contents. This paper is followed by a similar one upon Scandinavian anthropological literature, by Miss J. Mestorf, including much longer reviews upon publications in Denmark, Sweden and Norway. The crowning glory of the number, however, is a catalogue of recent anthropological literature, mostly in 1878 and 1879, by H. Müller, covering one hundred and fifty-three closely printed pages, and in many instances giving brief, pithy digests of the contents of the work. Such lists are valuable in a double sense. They enable specialists to find out what is being written on their favorite theme, but, better still, they give an *ensemble* of the scope and minutiæ of our science. Said a distinguished physicist to the editor of these Notes, upon reading over the list of titles published in the NATURALIST, "I really had no conception before of the rapid strides which this last of the sciences has been making."

ANTHROPOLOGY IN MEXICO.—The *Anales del Museo Nacional de Mexico*, has reached the second part of Vol. II. This number is devoted entirely to Mexican Archæology, containing the following papers by the three most eminent specialists in the Republic: 1. Historia de los Mexicanos por sus pinturas; articulo por el Sr. D. Joaquin Garcia Icazbalceta. 2. La piedra del Sol, segundo estudio, por el Sr. D. Alfredo Chavero (continuacion). 3. Codice Mendozino, Ensayo de descifracion geroglifica, por el Sr. D. Manuel Orozco y Berra (continuacion).

BRITISH PERIODICAL LITERATURE AND ANTHROPOLOGY.—Absence from one's sources of information for a few months accumulates literary material very rapidly. The three London periodicals, *Nature*, *The Athenæum*, and *The Academy*, gather up nearly all that is valuable in British anthropology and we give below the titles of articles and reviews that have appeared in these Journals from June 1 to October 1.

Reference to *The Athenæum*. The Survey of Palestine, June 19. Hittite Notes, by W. St. C. Boscawen, August 14. The Ethnical Relations of the Typical Man of South Wales, by Mr. F. W. Rudler, opening address before the Subsection of Anthropology in the British Association, also a review of Prof. Boyd Dawkins' address on "Primeval Man," and Mr. Francis Galton's lecture on "Mental Imagery," September 4.

Reference to *Nature*. A Scottish Crannog, with illustrations, May 6th and 13th. ["A full report of the Lochlee Crannog is given in Vol. XIII of the *Proceedings* of the Society of Antiquity of Scotland, and in Vol. II of the collections of the Ayrshire and Wigtownshire Archæological Association."] Abstract Report of Prof. Flower's Lectures on the Comparative Anatomy of Man, delivered at the Royal College of Surgeons, May 20th, May 27th, June 3d. Cup Stones, Cup-marked Stones, or Cups and Rings, May 27th, June 3d, June 10th, July 8th. Reviews of Prof. Dawkins' "Early Man in Britain and his place in the Tertiary Period," and of Principal J. W. Dawson's "Fossil Men and their Modern Representatives," May 27th. Review of Col. Mallery's Sign Language, June 3d. Review of Prof. Humphrey's Rede Lecture on Man, June 3d. Tribute to Dr. Paul Broca, July 29th. Address of F. W. Rudler, V. P. of Department of Anthropology, British Association, on the population of Southern Wales, September 2d.

References to *The Academy*. South European Folk-Lore, August 21st. The Earliest Rock-Hewn Monument in Asia Minor, by A. H. Sayce, August 28th.

COMPARATIVE THEOLOGY.—Under this title we include all discussions concerning the opinions which the different peoples of our globe have held respecting the first causes of phenomena, the nature of the soul and the phases of its existence after death, morality, worship, and sacred records. The latest utterance

upon this branch of anthropology is one of the most charming books we have ever read, entitled, "The Origin and Growth of Religion as illustrated by the Religion of Ancient Egypt. By P. Le Page Renouf. The Hibbert Lectures for 1879," published by Charles Scribner's Sons. The author prepares us for a proper comprehension of his theme by seeking to remove "those prejudices which incapacitate us from forming true judgments on systems alien to our own habits of thought." The first two lectures are entirely devoted to the treatment of those subsidiary questions which clear the way for the proper comprehension of the subject, such as the history of the decipherment of the hieroglyphics, the religious nature of the texts, Egyptian chronology as set forth in lists of sovereigns, genealogies and later writers, and including also prehistoric antiquity, ethnography, language, art, moral code, caste, and marriage customs. In the third lecture begins the special treatment of the subject. And the first thing that strikes us is the fact that for three thousand years we have a religion unchanged in its salient features. In the temple of each province, from early times, triads and enneads occur. As each locality had its own deity, it came to pass both that one god was worshiped in different aspects, and different gods were treated as the same divine person. This reminds us of the fashion among our own Indians of using the same animal in various tribes under different names as the head of their respective gentes; but these sacred animals are not the same in passing from one tribe to another. This inextricable confusion is simplified in the gods of the first order by reducing them to two categories: 1. Rā and his family; 2. Osiris and his family. Ra, the sun-god, is borne across the sky in a boat, he proceeded from Nu (the sky), the father of the gods. His adversary is Apap (darkness). Shu (the air), and Tefnut (the dew) are the children of Ra. Osiris (the sun), is the eldest of five children of Seb (the earth, also the goose), and Nut (the heaven mother). He wedded his sister Isis while in his mother's womb, and their offspring was the elder Horus (the Sun). Seb and Nephthys, another wedded pair, are their brother and sister. Seb slays Osiris, who, being avenged by Horus his son, reigns in the nether world. The discussion of monotheism in this chapter, pp. 92–96, the interpretation of the Egyptian word *nutar*, Power, pp. 96–108, and the Reign of Law, under the title of Maat, are among the best pieces of work in the book.

The fourth lecture is devoted to the rites of burial, the construction and ornamentation of their tombs, the *Ka* or genius, religious endowments, the material form and substance of the soul, possession, dreams, oaths, omnipresence of the gods, angels, destiny, and the divine vicegerency of the king. The religious books of Egypt are the theme of the fifth lecture. Chief among these is the so-called "Book of the Dead." It is indeed no book at all; but a collection

of chapters at first handed down by tradition, but afterwards committed to writing. They were supposed to be recited by the deceased person himself in the nether world, but were really said by those present at the funeral. These chapters are in papyrus rolls, on coffins, mummies, wrappings, statues and walls. The longest is the papyrus of Turin containing one hundred and sixty-five chapters. The chief subject of each chapter is the beatification of the dead, including renewed existence on earth, transformation into every desired shape, the range of the universe, and identification with Osiris and other gods. The use of amulets was carried to great excess: the scarabæi so frequently mentioned among ancient relics belong to this class. The lecture closes with a tribute to the moral doctrines of the Egyptians, in which the author repudiates the connection of the symbol of life with phallic worship. The religious systems are discussed in the last lecture under the title of hymns, Henotheism, Pantheism and Materialism.

The author while exhibiting the most excessive modesty is among the foremost Egyptologists, and does not fear to call Mr. Spencer, Mr. McLennan, and the champions of Dr. Thomas Young to order. One misses throughout the work formal classifications of myths and deities which would be exceedingly helpful to the student. A few outline drawings of the chief divinities would also contribute greatly to a comprehension of the text.

ARCHÆOLOGICAL EXPLORATIONS AT MADISONVILLE, OHIO.—The most thorough piece of archæological work with which we are acquainted at the present time, is the exploration of an ancient cemetery under the direction of the Literary and Scientific Society of Madisonville. The reports are prepared chiefly by Mr. C. F. Low, to whom we are indebted for copies. The explorations, begun in 1878, were first undertaken by Dr. Metz and others in order to save from loss and destruction the mound relics of the vicinity. While exploring a mound, a laborer, prospecting in the neighborhood, came upon a skeleton at a depth of two feet. Subsequent investigation revealed the fact that the entire plateau is the site of an ancient cemetery, from which have been exhumed upward of four hundred skeletons, accompanied by stone implements, pipes, pottery, charred matting and corn, tools and ornaments of bone, shell and copper. The reports are numbered I, II, III, and each succeeding one is a more careful report than the others of just what we desire to know. A detailed account of the whole exploration is in progress, and we shall not, therefore, speak querulously of the shortcomings of the present numbers. From the data before us we gather that there were two horizons of sepulture, the deep, averaging nearly four feet, and the shallow, averaging eighteen inches. Four-fifths of the bodies were interred in a horizontal position, not one-tenth in a sitting posture; and all the children were buried

stretched out. As far as indicated, the orientation was as follows: North, .07; south, .43; east, .22; west, .02; north-east, .03; south-east, .17; south-west, .02; north-west, .04. This, of course, is to be considered only as a very rough estimate; but the great preponderance of cases where the head is towards the south or the east is very noticable.

The most remarkable feature of the cemetery, however, is the presence of ashpits in great profusion (over two hundred have been explored), very few of which contain any human remains. They are about five or six feet deep, and contain the following layers: On the top leaf-mold has drifted in, and filled the cavity occasioned by the settling to a depth of two feet, more or less. The remaining space is filled with layers of charred wood, ashes and animal remains, clay, sand, and even corn, both shelled and on the cob. The bones and implements are not burned, which refutes the theory that the pits were for cremation. Many beautiful objects have been recovered from these ash-pits, and among them a bone implement entirely new. Plates 1 and 2 present lithographs of these bone drawing-knives or leather-smoothers (?).

THE REVUE D'ANTHROPOLOGIE.—Number three of this standard review bears on its title page the mournful news of the death of Dr. Paul Broca, which occurred on the night of July 8th. A full account of his labors will be given in the next *fasciculus*. The reviews are really more entertaining and valuable than the original contributions, excepting that of M Lagneau; but a list is appended with the hope that some of our readers may find cause to differ:

Notice sur la découverte de squelettes humains dans le lehm de Bollviller (Haut-Rhin), by M. J. Delbos.

Description des ossements humains fossiles trouvés dans le lehm de Bollviller, by Dr. Réné Collignon.

De la place de l'anthropologie dans les sciences, *réponse* à M. Wyrouboff, by Dr. Dally.

Note sur la secte des Simos, au sud du Sénégal, by Dr. Berenger-Feraud.

De quelques dates reculées intéressant l'ethnologie de l'Europe centrale, by Dr. Gustave Lagneau.

Monuments préhistoriques du Berry, by Ludovic Martinet.

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CLODD, E.—The later stone age in Europe. *Modern Rev.*, July.

CLOQUET, DR. N.—Etudes sur le préhistorique à l'Exposition universelle de Paris, 1878. Mons, 1880, pp. 64, 8vo.

COX, G. W.—The migration of popular stories. (*Fraser's Mag.*) *Eclectic*, Sept.

CUSHING, J. N.—Grammatical sketch of the Kakhyen language. *J. Roy. As. Soc. Gr. Br. &c.*, July.

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## GEOLOGY AND PALÆONTOLOGY.

THE VERTEBRATA OF THE EOCENE OF THE WIND RIVER BASIN.—The current number of the Bulletin of the U. S. Geological Survey of the Territories, contains a synopsis of the extinct species above referred to. They number forty-five, and of these twenty-six are new to science. The species are distributed as

follows: Fishes—*Clastes*, 1 sp.; *Pappichthys*, 1 sp. Reptiles—*Lacertilia*, 2 sp.; *Testudinata*, 2 sp.; *Crocodilia*, 1 sp. Mammals—*Chiroptera*, 1 sp.; *Rodentia*, 3 sp.; *Tæniodonta*, 1; *Insectivora*, 2; *Creodonta*, 9; *Mesodonta*, 9; *Amblypoda (Pantodonta)*, 2; *(Dinocerata)*, 1; *Perissodactyla*, 8; *? Artiodactyla*, 3. The new species are distributed as follows, all being *Mammalia: Chiroptera*, 1; *Tæniodonta* 1; *Insectivora* 2; *Creodonta* 8; *Mesodonta* 4; *Amblypoda*, 1; *Perissodactyla* 7; *? Artiodactyla* 2.

The facies of the fauna is that of the Wasatch rather than that of the Bridger epoch, but it contains, nevertheless, several genera hitherto regarded as characteristic of the Bridger; such are *Pappichthys* and *Palæosyops*. The sub-order *Dinocerata* has not previously been found associated with *Coryphodon*. The sole representative of this division belongs to a new genus, and is named *Bathyopsis fissidens*, by Prof. Cope. The genus is defined as follows: Dental formula, I. 3; C. 1; Prem. 4; M. 3,—in the lower jaw. First premolar in the series with the incisors and canine, and followed by a diastema. The entire inferior border of the lower jaw expanded downwards into a plate with convex inferior border, thus differing from *Uintatherium (Dinoceras)*, where the jaw is flared downwards in front only, and *Loxolophodon*, where there is little or no inferior expansion. There is a chamber-like enlargement of the dental canal, and a large mental foramen. The *B. fissidens* is about the size of the Malayan tapir. The anterior inner cusps of the inferior molars are double, and there is an oblique ridge commencing on the external border of the heel of the molars, and extending inwards and forwards.

Prof. Kerr on Frost Drift.—Prof. W. C. Kerr, State Geologist of North Carolina, read an interesting paper, February, 1880, before the American Institute of Mining Engineers, on what he calls *frost drift*, with especial reference to the gold deposits of his State. He finds a thick layer, sometimes amounting to a depth of one hundred feet, covering rocks in various parts of the State, which is evidently derived from their decomposition, and which has remained nearly in situ. He has observed, however, that the materials of these strata are frequently sorted, the larger undecomposed fragments lying near the bottom of the mass, hence it is evident that they have been moved, and without regard to the direction of the inclination of the surface. He thinks that this rearrangement has been produced by the alternate freezing and thawing of the bed. The gold of the placers has, in this way, gradually found its way to the bed-rock or slate, where it is now found by the miners. Placer mining has been practiced for many years in North Carolina, and the methods now in use in California, were carried there by emigrants from the former State.

Discoveries of Minerals in Western North Carolina.—

During the month of May, 1877, while on a buggy trip from Statesville to Hickory, I discovered from my buggy a deposit of drift gravel along the roadside a few miles east of the town of Hickory, which promised something handsome in the line of quartz crystals. I started out on the 4th day of the following June (1877) to trace out the indications offered by that pile of gravel scattered promiscuously along the roadside. By actual measurement, the belt of drift deposit extending a long distance with a north-east and south-west trend, was three-quarters of a mile in breadth. My first diggings were on the lands of Mr. E. Bolch, and, under my personal supervision, soon reached a pocket of water-bearing smoky quartz crystals at a depth of two feet under ground. Here I found my first basal plane on quartz crystals (smoky and clay-tessellated). Devoting my entire time to field work in the drift belt of this neighborhood, I examined nearly fifty different localities found either by myself or by workmen trained under my personal teaching. The result by the 1st of January, 1878, was the discovery of thirty-five new localities for the following list of minerals, together with a determination by myself of the separate species:

Water-bearing crystals of quartz; Carbon dioxide-bearing crystals of quartz; Smoky quartz crystals; Amethyst quartz crystals; Quartz crystals enclosing layers of red clay; Quartz crystals enclosing coloring matter of various hues; Quartz crystals enclosing other crystals; Quartz crystals enclosing small prisms of mica; Quartz crystals enclosing pyrites; Quartz crystals enclosing rutile. (The most magnificent specimen of which (7x4 in.) enclosing three beautiful rosettes of rutile, I presented to my friend Mr. Wilcox, of Philadelphia.)

Having seen in the cabinets of my friend Stephenson, of Statesville, a number of so-called seventh planes on the *prisms* of quartz crystals which he obtained in Alexander county, I went diligently to work for such localities in Catawba county. My search, at first, was fruitless, but I observed a singular feature in some of the crystals dug from this first pocket I had discovered in this county. This feature consisted of a well marked plane parallel to the lateral axis, or a plane truncating the *pyramid* at a right angle to the prism. This I claim is the first American locality for quartz crystals with basal planes; the locality itself, as also the observation of the peculiar planes, being my own original discoveries. I delayed the publication of my secret through fear of attracting attention to the locality. This was in June, 1877. In July and September following I had discovered fifteen new localities in the vicinity for water-bearing quartz crystals, obtaining as many as 550 specimens. During the same months I obtained nearly seventy crystals with the basal planes. My work continued through the months of October and November, when the winter caused a suspension of field labors.

In the month of March, 1878, my field explorations were renewed, and with almost continuous work, extending through the months of April, May, June, July, August, September and

October of the same year. I discovered and worked on fifty-six different new localities yielding the same species before mentioned, with the addition of

Black Tourmaline; Brown Tourmaline; Green Beryl; Melanite (garnets) in Muscovite; Sagenite (meshed rutile); Acicular rutile; Rutile in amethyst. (This last named species I also claim as having first discovered in this country, if not in the world.)

The result then of my field work in Catawba county, N. C., from the 4th day of June, 1877, to the 1st day of November, was the discovery of ninety-one new localities for minerals and the scientific determination of the following list of species obtained from these localities new to science:

Quartz crystals, drusy; do, reniform; do, botryoidal; do, asteriated; do, acicular; do, aventurine; do, filiform; do, reticulated; do, water-bearing; do, carbon dioxide-bearing; do, enclosing layers of red clay; do, enclosing coloring matter of various hues; do, enclosing other crystals; do, enclosing (microlites after Vogelsang); do, enclosing pyrites; do, enclosing small prisms of mica; do, enclosing rutile; do, (amethyst) enclosing acicular rutile; do, (amethyst) enclosing sagenite rutile.

Many of these were twins, geniculations, double terminals and in groups—varying in colors from black (of various shades) to the most pellucid variety, including green, yellow (citrine) smoky, purple, milky and almost every tint known to chemistry.

Crystallographically I have discovered in these new localities the following list of forms:

| | |
|---|---|
| Basal planes. | Trigonal prisms. |
| Hexagonal pyramids. | Rhombohedrals. |
| Dihexagonal " | Trapezohedrals. |
| Trigonal " | And hemimorphic forms. |

The weight of these separate crystals runs from one grain to one hundred pounds.

There are two very singular groupings among these crystals; the one being a number of amethyst crystals grouped upon a group of milky crystals, the other (resembling Fig. 335, p. 101, in E. S. Dana's Text Book of Mineralogy, Ed. 1877) being a series of quartz crystals all in a parallel position on the prism and pyramid faces of a group of acicular milky quartz crystals.

I believe I have discovered in this belt more than two-thirds of the forms of quartz known to science. This, however, I will determine before the year closes.

On a group of thirteen smoky crystals, having unitedly fifty-two easily discernible and movable bubbles, and nine different basal planes, there is one crystal with a basal plane and a cavity enclosing a gas, a liquid and a solid—the finest and most interesting specimen of its class which has ever been discovered.

In the months of July and August of 1878 I discovered two new localities, in Burke county, for basal planes on quartz, three new localities for sagenite and the golden colored rutile, two new localities for liquid-bearing crystals, one new locality for corun-

dum crystals with a border of fibrolite and enclosed in micaceous schist, one new locality for tourmaline, one new locality for aqua marine, and in conjunction with Mr. W. E. Hidden, I discovered forty-one different minerals in a few ounces of Brindlettown gold sands, being by far the largest and rarest number ever obtained at one time by an examination of these celebrated sands:

| | |
|---|---|
| Titanium. | Zircon. |
| Titanite. | Thorium. |
| Menaccanite vel Ilmenite. | Graphite. |
| Rutile. | Corundum (white). |
| Anatase vel Octahedrite. | " (blue). |
| Octahedrite. | " (red). |
| Ilmenite. | " (gray). |
| Brookite. | " (yellow). |
| Iron. | Feldspar. |
| Limonite. | Albite. |
| Mag. Iron. | Actinolite. |
| Granite. | Tourmaline. |
| Gneiss. | Schorl. |
| Itacolumite. | Epidote. |
| Quartz. | Beryl. |
| Garnet. | Tremolite. |
| Schist. | Hornblende. |
| Monazite. | Soapstone. |
| Amethyst. | Kyanite. |
| Gold. | Cairngorm Stone. |

This paper, in conclusion, is merely to place on record the results of my three years' field work amongst the minerals of North Carolina, until I can elaborate them (with engravings) in a substantial book form.—*John T. Humphreys, Greensboro, N.C.*

GEOLOGICAL NEWS.—Prof. Hitchcock is preparing a new geological map of the United States.——Prof. Hall has identified the Oneonta and Montrose sandstones, and finds them to form a fresh-water deposit below the Chemung.——Prof. Collett has found a remarkable deposit of extinct Unionidæ in Vandenburg county, Ia.——Prof. Leidy has determined a number of species of Vertebrata from bones found in a cave in Northampton county, Pa. All of the species are existing excepting two, a *Castoroides* and a Peccary. —— Mojsisovics and Neumayr are publishing an extensive work, Beiträge zur Palaeontologie von Oesterreich-Ungarn. The two first monographs have appeared; they are Lugmayer on Rhætic *Brachiopoda*, and Bittner on Early Tertiary *Echinida* of the Southern Alps.

## GEOGRAPHY AND TRAVELS.[1]

THE EXPLORATIONS OF CAPELLO AND IVENS IN WEST CENTRAL AFRICA.—In previous numbers of the NATURALIST some accounts have been given of the expedition fitted out early in 1877, by the Government of Portugal and the Lisbon Geographical Society for the exploration of western and southern Central Africa. The party was under the command of Major Serpa Pinto, and started

[1] Edited by ELLIS H. YARNALL, Philadelphia.

from Benguela on the west coast, proceeding by a southern route, touching the fifteenth parallel of south latitude, entering the mountainous region of Dombé, and passing to the east of Quillengues, finally reached Bihé in March, 1878. Here Major Serpa Pinto left his companions and started on his perilous journey along the upper waters of the Quando and Zambesi, and thence southward through the Transvaal and Natal to the east coast.[1]

Captain B. Capello and Lieutenant R. Ivens left Bihé in May, pursuing a north-easterly direction, crossing the Quanza, whose source is the Mussombo lake in S. lat. 13° 30′, E. long. 17°, and after long marches through an overflowed country, on June 24th arrived at the Luando, an important tributary of the Quanza. To the north of this stream are the tribes of the Songos and Quiocos, while the Ganguellas, a strong powerful race of men who carry on an active trade with Bihé, occupy the country to the south. At the distance of two hundred and fifty miles from Bihé the forest district of Quioco was reached, one of the most interesting of Central Africa in its hydrographical character. From here the expedition followed the Quango river, Capello taking the east, and Ivens the west side of the stream. Both found the country very difficult to penetrate owing to the overflowing of the river, and its many tributaries, the density of the vegetation and the broken irregular character of the surface. The explorers met finally at Cassange, and made several excursions east and north from that point. Proceeding from there to Malange, and turning north, they followed the eastern slope of the Tala-Mogongo range, crossing many streams flowing into the Hamba, an important affluent of the Quango to the forest country of Hungo. Marching on they discovered a great number of streams and countless small lakes. MM. Capello and Ivens believe that these should take the place of the large lake, Aquilonda, found on many maps at this point (7° S. 17° E.), and which they state does not exist. After arriving at a small village called Malundo, about 7° 30′ S. and 16° 30′ E. they were obliged to retrace their steps owing to the exhaustion of their stores, illness, and the difficulties of the country.

To the east of the Quango here is the country of Jaca, one of the most important of the African interior, which extends as far as the Congo and was entirely unknown previously. The return was made to the Portuguese settlement of Duque de Braganza on the Lucalla, and through a fruitful, healthy country to the Quanza, the course of which river they followed down to the sea. They reached Portugal in January last, and this account is taken from papers read by them before the Lisbon Geographical Society, and the Geographical Section of the British Association. A beautiful detailed map in MS. of the country explored was exhibited at the

[1] NATURALIST, September, 1879, p. 593.

latter. The route is roughly shown in a "Provisorische Karte," published in *Petermann's Mittheilungen* for September, 1880.

The total length of the land journey thus accomplished was 4214 kilometers.

As to general configuration, the whole region of West Africa covered by the expedition south of the equator may be described as consisting of three well-marked areas: I. A central table-land where the richness of the soil and the regularity of the rain-fall cause a luxurious and varied vegetation; II. A hilly region surrounding the table-land and forming a water-shed dividing the waters of the Quanza, Cunene, Cubango and other large rivers, and possessing a less luxuriant but abundant flora, and a variety of fruits and vegetables; III. A zone of lowland near the coast barren and unhealthy from the many swamps.

Between Benguela and Bihé innumerable streams were crossed, almost all of them having their sources in the elevated central regions, and reaching the coast by successive rapid descents between the 9th and 17th parallels of latitude. Among the most remarkable is the Copororo (the left bank of which was followed by the expedition), the Cunene, and the Cubango (the course of which, by exception, is towards the south-east). All these rivers are extremely tortuous and full of rocks, and their currents being rapid, they seem in general to be little adapted for any kind of navigation.

Another peculiarity of the river systems is the tendency of the innumerable affluents on each side to flood their banks, thus rendering their survey extremely difficult. All take their rise on the northern or southern slopes of the great central ridge which traverses the interior in the latitude of Quioco, south of Bihé, and is prolonged south of Lake Bangweolo under the name of Muchinga, to the plateau of Lobisa. This is the most important elevation of Central Africa south of the equator, as it forms the dividing point between the basins of the Congo and the Zambesi, in conjunction with another elevated ridge called Mossambé, running north and south, and intersecting it in 12° S. lat., and 18° E. long., on which are the sources of innumerable affluents of the Zambesi and the Congo.

On account of this intersection taking place near it, the region of Quioco must be considered as of high interest to the scientific geographer, and well deserving of the epithet of "Mother of Waters" in south-west Central Africa. In the space of 1000 square miles around the residence of a chief named Mune Quibau the expedition discovered, at distances not more than twenty miles apart, the source of five or six of the most important rivers of the continent, viz: the Quango, the Kassai, the Luando, the Chicopa, the Lume, and the Jombo, besides about a hundred smaller streams, tributaries of the preceding.

The Quango at first flows between the two great mountain

ranges of Tala-Mogongo (on the west) and Moenga (on the east) forming many cataracts and rapids, and receiving many affluents, all of which were surveyed. The most important falls are six in number, the last being situated in 8° S. lat. Many of the affluents were previously unknown. In the 7th parallel of south latitude, the mountain range of Tala-Mogongo cuts obliquely another system of sierras, named in the north, Zombo, which extends to the Congo above the Yellala falls. The extensive region of small lakes before mentioned is situated on the slopes of this latter mountain range, and the expedition charted various rivers having their origin in the range as also all the numerous streams of the western slope in the Luamba region. With regard to the natives—all belonging to the great Bantu division of the Ethiopian race—the general observation may be made that the physical, mental and social development of the very varied tribes improves in the ratio of the altitude of the locality. The greater the altitude of his home the more perfect is the native, and the natives of the coast region are the most rachitic, the least intelligent and the most unfortunate of all. In the industrial arts it is also remarkable that the tribes farthest in the interior, and therefore most remote from European contact, are the most ingenious. The coast native does not manufacture a knife for his own use, the inhabitant of the plateau does; the latter even manufactures hoes, and sells them to the degraded coast negro. The difference is enormous between the Ganguella and the Maiaca, the one living at an altitude of 5500 feet, in a climate of 64° mean temperature, and the other at an altitude of 1600 feet, in a mean temperature of 80°.

The political system is very similar in all the tribes. Each has a chief who at times transmits his power to his successors in a collateral line, while at other times a chief is elected by the people. Polygamy is characteristic of the lowest tribes; fetishism and the most brutal superstition and slavery everywhere prevail.

The expedition collected material throughout their journey towards vocabularies of the many native languages. Being furnished with a very complete outfit of scientific instruments, they have been able to bring home an extensive series of observations in magnetism and meteorology as well as in all appertaining to their special work, the fixing of positions by astronomical and hypsometrical observations, and the geographical survey of the regions traversed.

Col. Prejevalsky.—Further accounts received from Col. Prejevalsky informs us, that in May last he was at Houi-dé on the Hoang-ho. He left Sining on March 20th, and explored the Yellow river for one hundred miles or more, but was unable to proceed further or ascertain the sources of this great river. At Gomi, where the river is 8000 feet above the sea-level, it is from 420 to 490 feet wide. Above this place their "progress was fre-

quently arrested by deep ravines, which seam the banks, and suddenly disclose their precipitous and dismal depths, the more unexpectedly as the plain over which one happens to be marching appears to be perfectly level. A river usually flows at the bottom of these enormous crevasses bordered with trees and shrubs. Footpaths lead into many of them, but the descent is most difficult, especially for mules and pack-camels."

On reaching the mouth of the Churmysh, and reconnoitering the country for a distance of nearly thirty miles, Prejevalsky "became convinced of the impossibility of crossing the enormous mountain-chain extending along the Yellow river. The summits of these mountains are lost in clouds, gloomy ravines are encountered at every verst, and there is not the slightest trace of vegetation, therefore no forage for our animals. Pursuing my investigations further, I saw clearly that our mules could never go round these mountains, the roads being only accessible for camels accustomed to the privations of the desert, and it is even doubtful if camels could accomplish the ascent of the Burkan-Buddha." He therefore turned back down the stream to Houi-dé, forty miles below Gomi, arriving there two months after his departure from Sining.

Five hundred specimens of birds and many fishes and plants have been collected. "Blue pheasants were particularly numerous. This fine bird, only a few specimens of which may be seen in the Museums of Paris, St. Petersburg, and London is met with frequently at an altitude of 9500 feet. Every day we killed several, and preserved twenty-six for our collections. Had it not been for difficulty of transport, we might have collected hundreds. The second rarity of this country is rhubarb, often found in large quantities. Old roots of it grow to a colossal size. One of those I took measured sixteen inches in length, twelve in breadth, and seven in thickness, and weighed twenty-six pounds."

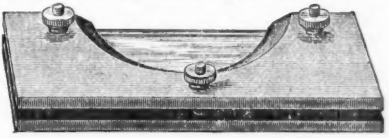
## MICROSCOPY.[1]

ADULTERATIONS OF DRUGS.—A report on this subject by C. Lewis Diehl, in the National Board of Health Bulletin, states that most of the information that can be gained on the subject is too vague or general in its character to be satisfactory. It is understood that the falsification of drugs is carried on extensively at the present time, and it is known that certain drugs are particularly subject to adulteration or falsification, but there is great difficulty in obtaining particulars that are definite or valuable. The literature of the subject, except a few papers of general scope, is mostly included in the standard text books of pharmacy, and in the Proceedings of the American Pharmaceutical Association, which have been published annually since 1852. The author discriminates carefully between deteriorations which may take place

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

by time or by improper exposure to causes of change, and substitutions which may be made unintentionally or without the knowledge of the vender, and adulterations which imply intentional debasement for the purposes of deception and gain. The general conclusion is reached that the drug market is so fairly honest that persons who really desire to obtain articles of standard quality, and at a proportionate price, have very little difficulty in being able to do so, and can be suited by respectable dealers throughout the land, while poor and adulterated articles are present, and are very likely to be obtained by ignorant persons or by those who are indifferent to the character of the dealer, and are desirous of regulating their purchases by the price rather than the quality of the goods. Crude drugs can usually be obtained of good quality, though many are sold, which have deteriorated by prolonged or careless preservation. Powdered drugs (those of fair quality can usually be obtained) are liable to the grossest adulterations, particularly those which are frequently handled (like spices) by both grocers and druggists. That this practice still continues is shown by the fact that powders are often sold at the price of, or at an inadequate advance upon, the crude drug, notwithstanding the loss incurred in drying and powdering. Infusions, decoctions, solid and fluid extracts, and tinctures are all found to vary in strength and quality from good and indifferent to positively bad; some manufacturers adhering to the requirements of the Pharmacopœia, while others admit inferiorities in order to save cost and to be able to undersell.

Hard Rubber Zoophyte Trough.—A new zoophyte trough, just brought to notice, is so neat, convenient, and free from faults that it cannot fail to be used with pleasure. Two plates of glass, somewhat like glass object slides, are separated by a half ring of soft rubber, and clamped together by two plates of hard rubber, held together by binding screws, and cut away to show the objects, as illustrated in the engraving.



. These troughs contain many valuable features; any thickness of glass can be used, and it can be easily taken out for cleaning, and easily replaced if broken, and the thickness of the cell can be varied indefinitely by using different thicknesses of sheet rubber between the glasses. The whole contrivance is an adaptation, in a most attractive and valuable form, of the troughs which have been used for holding living objects, and for exhibiting crystallization, in the projecting microscope. It can be obtained from Mr. Walmsley, manager for R. & J. Beck, 1016 Chestnut Street, Philadelphia.

The Acme Microscopes.—John W. Sidle & Co., of Lancaster, Pa., have issued a catalogue which gives a fair representation

latter. The route is roughly shown in a "Provisorische Karte," published in *Petermann's Mittheilungen* for September, 1880.

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As to general configuration, the whole region of West Africa covered by the expedition south of the equator may be described as consisting of three well-marked areas: I. A central table-land where the richness of the soil and the regularity of the rain-fall cause a luxurious and varied vegetation; II. A hilly region surrounding the table-land and forming a water-shed dividing the waters of the Quanza, Cunene, Cubango and other large rivers, and possessing a less luxuriant but abundant flora, and a variety of fruits and vegetables; III. A zone of lowland near the coast barren and unhealthy from the many swamps.

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Another peculiarity of the river systems is the tendency of the innumerable affluents on each side to flood their banks, thus rendering their survey extremely difficult. All take their rise on the northern or southern slopes of the great central ridge which traverses the interior in the latitude of Quioco, south of Bihé, and is prolonged south of Lake Bangweolo under the name of Muchinga, to the plateau of Lobisa. This is the most important elevation of Central Africa south of the equator, as it forms the dividing point between the basins of the Congo and the Zambesi, in conjunction with another elevated ridge called Mossambé, running north and south, and intersecting it in 12° S. lat., and 18° E. long., on which are the sources of innumerable affluents of the Zambesi and the Congo.

On account of this intersection taking place near it, the region of Quioco must be considered as of high interest to the scientific geographer, and well deserving of the epithet of "Mother of Waters" in south-west Central Africa. In the space of 1000 square miles around the residence of a chief named Mune Quibau the expedition discovered, at distances not more than twenty miles apart, the source of five or six of the most important rivers of the continent, viz: the Quango, the Kassai, the Luando, the Chicopa, the Lume, and the Jombo, besides about a hundred smaller streams, tributaries of the preceding.

The Quango at first flows between the two great mountain

ranges of Tala-Mogongo (on the west) and Moenga (on the east) forming many cataracts and rapids, and receiving many affluents, all of which were surveyed. The most important falls are six in number, the last being situated in 8° S. lat. Many of the affluents were previously unknown. In the 7th parallel of south latitude, the mountain range of Tala-Mogongo cuts obliquely another system of sierras, named in the north, Zombo, which extends to the Congo above the Yellala falls. The extensive region of small lakes before mentioned is situated on the slopes of this latter mountain range, and the expedition charted various rivers having their origin in the range as also all the numerous streams of the western slope in the Luamba region. With regard to the natives—all belonging to the great Bantu division of the Ethiopian race—the general observation may be made that the physical, mental and social development of the very varied tribes improves in the ratio of the altitude of the locality. The greater the altitude of his home the more perfect is the native, and the natives of the coast region are the most rachitic, the least intelligent and the most unfortunate of all. In the industrial arts it is also remarkable that the tribes farthest in the interior, and therefore most remote from European contact, are the most ingenious. The coast native does not manufacture a knife for his own use, the inhabitant of the plateau does; the latter even manufactures hoes, and sells them to the degraded coast negro. The difference is enormous between the Ganguella and the Maiaca, the one living at an altitude of 5500 feet, in a climate of 64° mean temperature, and the other at an altitude of 1600 feet, in a mean temperature of 80°.

The political system is very similar in all the tribes. Each has a chief who at times transmits his power to his successors in a collateral line, while at other times a chief is elected by the people. Polygamy is characteristic of the lowest tribes; fetishism and the most brutal superstition and slavery everywhere prevail.

The expedition collected material throughout their journey towards vocabularies of the many native languages. Being furnished with a very complete outfit of scientific instruments, they have been able to bring home an extensive series of observations in magnetism and meteorology as well as in all appertaining to their special work, the fixing of positions by astronomical and hypsometrical observations, and the geographical survey of the regions traversed.

Col. Prejevalsky.—Further accounts received from Col. Prejevalsky informs us, that in May last he was at Houi-dé on the Hoang-ho. He left Sining on March 20th, and explored the Yellow river for one hundred miles or more, but was unable to proceed further or ascertain the sources of this great river. At Gomi, where the river is 8000 feet above the sea-level, it is from 420 to 490 feet wide. Above this place their "progress was fre-

quently arrested by deep ravines, which seam the banks, and suddenly disclose their precipitous and dismal depths, the more unexpectedly as the plain over which one happens to be marching appears to be perfectly level. A river usually flows at the bottom of these enormous crevasses bordered with trees and shrubs. Footpaths lead into many of them, but the descent is most difficult, especially for mules and pack-camels."

On reaching the mouth of the Churmysh, and reconnoitering the country for a distance of nearly thirty miles, Prejevalsky "became convinced of the impossibility of crossing the enormous mountain-chain extending along the Yellow river. The summits of these mountains are lost in clouds, gloomy ravines are encountered at every verst, and there is not the slightest trace of vegetation, therefore no forage for our animals. Pursuing my investigations further, I saw clearly that our mules could never go round these mountains, the roads being only accessible for camels accustomed to the privations of the desert, and it is even doubtful if camels could accomplish the ascent of the Burkan-Buddha." He therefore turned back down the stream to Houi-dé, forty miles below Gomi, arriving there two months after his departure from Sining.

Five hundred specimens of birds and many fishes and plants have been collected. "Blue pheasants were particularly numerous. This fine bird, only a few specimens of which may be seen in the Museums of Paris, St. Petersburg, and London is met with frequently at an altitude of 9500 feet. Every day we killed several, and preserved twenty-six for our collections. Had it not been for difficulty of transport, we might have collected hundreds. The second rarity of this country is rhubarb, often found in large quantities. Old roots of it grow to a colossal size. One of those I took measured sixteen inches in length, twelve in breadth, and seven in thickness, and weighed twenty-six pounds."

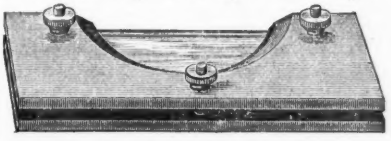
## MICROSCOPY.[1]

ADULTERATIONS OF DRUGS.—A report on this subject by C. Lewis Diehl, in the National Board of Health Bulletin, states that most of the information that can be gained on the subject is too vague or general in its character to be satisfactory. It is understood that the falsification of drugs is carried on extensively at the present time, and it is known that certain drugs are particularly subject to adulteration or falsification, but there is great difficulty in obtaining particulars that are definite or valuable. The literature of the subject, except a few papers of general scope, is mostly included in the standard text books of pharmacy, and in the Proceedings of the American Pharmaceutical Association, which have been published annually since 1852. The author discriminates carefully between deteriorations which may take place

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

by time or by improper exposure to causes of change, and substitutions which may be made unintentionally or without the knowledge of the vender, and adulterations which imply intentional debasement for the purposes of deception and gain. The general conclusion is reached that the drug market is so fairly honest that persons who really desire to obtain articles of standard quality, and at a proportionate price, have very little difficulty in being able to do so, and can be suited by respectable dealers throughout the land, while poor and adulterated articles are present, and are very likely to be obtained by ignorant persons or by those who are indifferent to the character of the dealer, and are desirous of regulating their purchases by the price rather than the quality of the goods. Crude drugs can usually be obtained of good quality, though many are sold, which have deteriorated by prolonged or careless preservation. Powdered drugs (those of fair quality can usually be obtained) are liable to the grossest adulterations, particularly those which are frequently handled (like spices) by both grocers and druggists. That this practice still continues is shown by the fact that powders are often sold at the price of, or at an inadequate advance upon, the crude drug, notwithstanding the loss incurred in drying and powdering. Infusions, decoctions, solid and fluid extracts, and tinctures are all found to vary in strength and quality from good and indifferent to positively bad; some manufacturers adhering to the requirements of the Pharmacopœia, while others admit inferiorities in order to save cost and to be able to undersell.

Hard Rubber Zoophyte Trough.—A new zoophyte trough, just brought to notice, is so neat, convenient, and free from faults that it cannot fail to be used with pleasure. Two plates of glass, somewhat like glass object slides, are separated by a half ring of soft rubber, and clamped together by two plates of hard rubber, held together by binding screws, and cut away to show the objects, as illustrated in the engraving.



. These troughs contain many valuable features; any thickness of glass can be used, and it can be easily taken out for cleaning, and easily replaced if broken, and the thickness of the cell can be varied indefinitely by using different thicknesses of sheet rubber between the glasses. The whole contrivance is an adaptation, in a most attractive and valuable form, of the troughs which have been used for holding living objects, and for exhibiting crystallization, in the projecting microscope. It can be obtained from Mr. Walmsley, manager for R. & J. Beck, 1016 Chestnut Street, Philadelphia.

The Acme Microscopes.—John W. Sidle & Co., of Lancaster, Pa., have issued a catalogue which gives a fair representation

of their new enterprise. Besides the very simple and excellent Acme microscopes and the accessories belonging to them, much information is given in regard to microscopical supplies in general.

THE SPENCER OBJECTIVES.—The partnership heretofore existing between C. A. Spencer & Sons, has been dissolved, and Herbert R. Spencer announces that he will hereafter furnish lenses marked H. R. Spencer & Co., made after the same formulas, and of the same uniform excellence, which have for years past characterized the lenses made under his supervision, by the old company.

GUTTA PERCHA CELLS.—These rings for mounting dry objects, can be obtained from Lloyd H. Smith, of Geneva, N. Y., at from fifty to eighty cents per hundred. They are such as are used by Prof. H. L. Smith, and are suitable for diatoms and other thin objects.

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## SCIENTIFIC NEWS.

— The U. S. Entomological Commission designs preparing for publication, probably in the appendix of its third report, a bibliography of American (and Canadian) economic entomology. The bibliography will contain references to papers, articles and notes in agricultural and popular scientific periodicals, as well as journals devoted to bee culture, and as complete as possible references will be made to entomological notes in those periodicals which appeared prior to 1850. The titles of notes, articles, reports on works, will be entered under the name of authors, or of periodicals, especially agricultural reports and papers, with brief digest of contents given in a line or two, in the same style as in Mr. Mann's excellent bibliographical record of *Psyche*, the organ of the Cambridge Entomological Club, of Cambridge, Mass.

After due pains are taken such a record will necessarily be quite imperfect. The compiler will have to rely much on aid from authors of any and every article or note on economic entomology. Its completeness will greatly depend on the care with which entomologists may prepare lists of their own articles. Entomologists are therefore earnestly requested to coöperate by sending full lists of their papers or notes on any subject connected with *economic entomology* (not general or scientific entomology unless bearing on the applied science) and prepared in the style of that of *Psyche*, to A. S. Packard, Jr., at Providence, R. I.

— Jacob Boll, of Dallas, Texas, died recently in Western Texas at a distance from civilization. He was a native of the Canton of Aargau, Switzerland, and was a pupil of Agassiz before the latter came to the United States. He was active in promoting educational reform in his native country, and was an authority in entomology. During a long residence in Texas he was an untiring collector, and sent many specimens to Europe. His collections of insects, especially of Lepidoptera, are une-

qualed for beauty. He was a good geologist, and contributed articles to various journals, including the AMERICAN NATURALIST. For two years previous to his death he was engaged in explorations, for Prof. Cope, in the Permian region of Texas. He discovered numerous remarkable extinct vertebrates, which have formed the subject of various papers. These number thirty-two species, and they have thrown great light on the nature of vertebrate life at that early period. Mr. Boll was a most amiable man, and his death is a serious loss to science.

— The report of the committee on science teaching in schools, read by Dr. Youmans before the American Association, arraigns the unscientific methods by which science is usually mistaught in schools. He justly claims that science, as a means of training the faculties in the various ways to which they are severally adapted, is not taught in the public schools. It is not made the means of cultivating the observing powers, or of stimulating inquiry, or of exercising the judgment in weighing evidence, or of forming original and independent habits of thought. Wide personal differences of capacity, aptitude, attainment and opportunity not only exist among children, but they are the prime data of all efficient mental cultivation. In the graded schools, just in proportion to the perfection of the mechanical arrangements, individuality disappears; and with individuality goes originality. Science, if rightly pursued, is the most valuable school of self-instruction. From the beginning men of science have been self-dependent and self-reliant, because self-taught.

— Mr. Alfred R. Wallace has published, says the *Academy*, a new work entitled "Island Life," which deals with the problems presented by insular faunas and floras by the aid of the most recent geological and physical researches. A special feature in the work is the importance attached to former changes of climate; as indicated by glacial phenomena and the luxuriant floras of polar regions; these are carefully investigated, and a somewhat novel solution of the whole problem of geological climates is given.

— The third annual book of the Michigan Sportsmen's Association contains some excellent reading matter. The report on nomenclature, barring some inaccuracies, is an excellent one, and most timely, as is Mr. Fred. Mather's and Mr. J. G. Portman's papers on fish propagation and protection. Such associations and publications as these, will tend greatly to increase the interest of the public in economic zoölogy and all that pertains to it.

— The conch fisheries of the Bahamas, according to the *Scientific American*, are of considerable importance, many tons being exported to Italy, France and Germany from Nassau; in Italy they are cut into sleeve buttons and brooches, and in France and Germany they are used in porcelain manufactories. $50,000 worth of conch pearls are annually exported from Nassau.

— Dr. Anton Fritsch is making a series of galvanoplastic models of the Stegocephali found by him in the Gas-Kohle of Bohemia, which will be of much use to palæontologists, judging by a specimen which we have received. They are for sale by Dr. Fritsch, at Prague, or Mr. Jamrach, 180 St. George street, London, Nos. 1–18, at 100 marks.

— Having observed, among the Artemisias which cover immense regions of North America, neither flies, nor worms, nor any insects (also no scorpions or tarantulas), M. Poirot has suggested that the plant might prove adverse to the metamorphoses of phylloxera, by covering the ground with branches of *Artemisias*.

— The entomologists of New York have organized a society under the name of the "New York Entomological Club," and in January issued the first number of *Papilio*, the organ of the club.

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## PROCEEDINGS OF SCIENTIFIC SOCIETIES.

National Academy of Sciences.—Papers read at the session commencing Tuesday, November 16, 1880, at New York:— 1. Report on the dredging cruise of the U. S. Steamer *Blake*, Commander Bartlett, during the summer of 1880, by Alexander Agassiz. 2. On the origin of the coral reefs of the Yucatan and Florida banks, by Alexander Agassiz. 3. On some recent experiments in determining the electromotive force of the Brush dynamo-electric machine, by Henry Morton. 4. Measurement of new forms of electric lamps operating by incandescence, by Henry Morton. 5. On the intimate structure of certain mineral veins, by Benjamin Silliman. 6. Mineralogical notes, by Benjamin Silliman. 7. The relationship of the carboniferous Euphorberia to living and extinct Myriapods, by Samuel H. Scudder. 8. On the structure of the extinct *Carnivora* of the family *Nimravidæ*, by E. D. Cope. 9. On the Canidæ of the Miocene period, by E. D. Cope. 10. On the basin of the Gulf of Mexico, by J. E. Hilgard. 11. On the origin of the coral reefs of the Yucatan and Florida banks, by Alexander Agassiz. 12. Observations on ice and icebergs in the polar regions, by F. Schwatka. 13. On the duration of the Arctic winter, by F. Schwatka. 14. On the ellipticity of the earth as deduced from pendulum experiments, by C. S. Pierce. 15. On an improvement in the Sprengel Air-pump, by O. N. Rood. 16. On the thermal balance, by S. P. Langley. 17. On measurement of radiant energy, by S. P. Langley. 18. Causes which determine the progressive movement of storms, by Elias Loomis. 19. On the antimony mines of Southern Utah, by J. S. Newberry. 20. On the conglomerate ore deposits of the United States and Mexico, by J. S. Newberry. 21. On photographing the Nebula in Orion, by Henry Draper. 22. On condensers for currents of high potential, by George F. Barker.

23. On Sigsbee's gravitating trap, by Alexander Agassiz. 24. On the deposits of crystalline iron ores of Utah, by J. S. Newberry. 25. On the origin of anthracite, by T. Sterry Hunt. 26. On the star-list of Abul Hassan, by C. H. F. Peters. 27. Dimensions of the brain and spinal cord in some extinct reptiles, by O. C. Marsh.

PROCEEDINGS OF THE ACADEMY OF NATURAL SCIENCES, PHILADELPHIA, Sept. 28.—The following papers were presented for publication: "The Parasites of the Termites," by Joseph Leidy, M.D. "Remarks on *Bathygnathus borealis*," by Joseph Leidy, M.D. Dr. Kœnig remarked on Jarusite from Colorado.

Oct. 5.—Mr. Martindale spoke on an unusual peculiarity of growth in the chestnut. Messrs. Meehan and Potts on transformation of starch in growth. Dr. Hough called attention to the decay of *Abies nigra* in Maine and the Adirondack region. Dr. Horn on insects in wood.

Oct. 12.—Mr. Barbeck remarked on *Empusa muscæ* and Fungi on oaks. Rev. Dr. McCook recorded the discovery of cutting ants in New Jersey, and also spoke on honey ants from Australia. Dr. Kœnig described a substance composed of six atoms of lead, two of bismuth, and nine of sulphur, from Colorado, which he proposed calling Begarite. Dr. McCook and Dr. Horn discussed the distribution of insects.

Oct. 19.—Mr. Ford spoke on the natural history of the oyster.

Oct. 26.—Dr. Horn remarked on the classification of the Carabidæ.

Nov. 2.—Mr. Meehan remarked on moisture upon blossoms of *Yucca gloriosa*. Dr. Horn on *Dynastes hercules* and tannic acid of galls.

BOSTON SOCIETY OF NATURAL HISTORY, Nov. 17.—Dr. M. E. Wadsworth read a paper on the amygdaloidal structure and vein formation, with special reference to the copper-bearing rocks of the Keweenaw district of Lake Superior, being a reply to Prof. James D. Dana. Dr. B. Joy Jeffries spoke of a peculiar look of the color-blind, which is little recognized but curiously interesting. Mr. F. W. Putnam showed a carved human bone found in Maine, and remarked on its character and origin. Mr. S. W. Garman described the early stages in the development of the tree toad, and described a case of "a toad found in solid rock."

Dec. 1.—Mr. J. Orne, Jr., read a sketch of the late Mr. Geo. D. Smith. Dr. M. E. Wadsworth discussed the appropriation of the name "Laurentian" by the Canadian Geological Survey. The president gave further details of the structure of the carboniferous centipedes, to show that they should be classed as a distinct sub-order of Myriapods. Dr. E. Palmer exhibited some objects of archæological interest taken from caves in Mexico.

NEW YORK ACADEMY OF SCIENCES, Nov. 8.—Prof. Newberry made a communication on the antimony mines of Southern Utah. Prof. D. S. Martin exhibited specimens of wax from the Carnauba palm of Northern Brazil, and gave an account of its production, etc.

Nov. 22.—Miss Adelina Bierck described the volcanic eruption at Lake Ilopango, San Salvador, and Mr. A. A. Julien gave an account of a visit to the great alum cave of Sevier county, Tennessee.

Nov. 29.—Prof. H. A. Ward gave a description of the Island of Volcano.

AMERICAN GEOGRAPHICAL SOCIETY. Nov. 18.— Rev. Owen Street read a paper on the changes in the physical geography of the ancient home of man in Central and Western Asia.

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## SELECTED ARTICLES IN SCIENTIFIC SERIALS.

ZEITSCHRIFT FÜR WISSENSCHAFTLICHE ZOOLOGIE—Nov. 6. On the relationship of the Cephalopoda, by H. von Ihering. The organ of smell of the land pulmonates, by Dr. D. Sochaczewer. (Refers to the structure of the feelers, and Moquis Tandon's opinion that the end or "terminal button" is the seat of the organ of smell. He then discusses the nature of the organ of Semper and of the foot-glands, and thinks that the latter are more properly organs of smell, as at the base of the excretory duct of the pedal gland are distinct ciliated sense-cells which are like the ciliated sense cells in the skin of mollusks discovered by Flemming.) On the cases of the Trichopterous larvæ of Santa Catharina, Brazil, by Fritz Müller. (Figures and describes a great variety of singular forms of caddis-fly cases.) Researches on the Dysideidan and Phorio-sponges, by W. Marshall. On two early human embryos, by W. Krause (with excellent figures). The pedal nerve-system of *Paludina vivipara*, by H. Simroth.

THE GEOLOGICAL MAGAZINE — November. Precambrian volcanos and glaciers, by H. Hicks. The Mammoth in Siberia, by H. H. Howorth.

DATES OF PUBLICATION OF THE NATURALIST FOR 1879 AND 1880. —1879: January No., January 4th; February, February 4th; March, February 27th; April, March 26th; June, May 20th; July, June 17th; September, August 22d; November, October 25th; December, December 4th. 1880: January, January 2d; February, January 31st; March, February 25th; April, March 21st; May, April 27th; June, May 21st; July, June 18th; August, July 22d; October, September 21st; November, October 23d; December, November 25th.